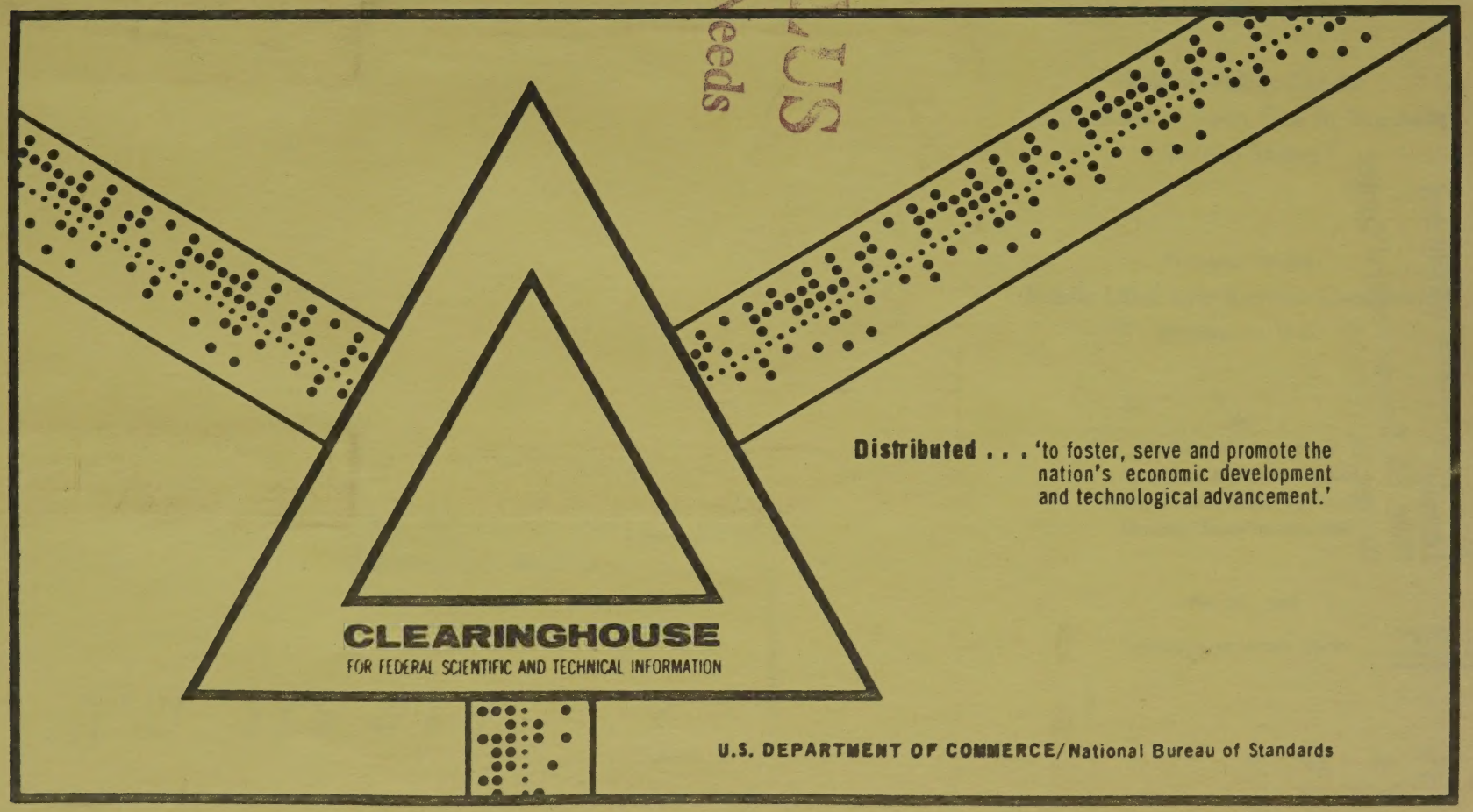
PUBLIC LAND LAW REVIEW COMMISSION

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE

VOLUME IV (Working Papers)

The Economics Department
Agricultural Experiment Station
South Dakota State University

Revised October 1969



Federal public land laws and policies relating to intensive agriculture.

Federal Public Land Laws and Policies Relating to Intensive Agriculture

WORKING PAPER

Federal Public Lands: Economics of Farm Size in Western United States

Prepared for the

Public Land Law Review Commission

Washington, D. C.

By

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APRIL 30, 1969

REVISED OCTOBER 1969

Prepared under contract with the Public Land Law Review Commission.

This publication constitutes only one of a number of sources of information utilized by the Commission in the conduct of its public land study program.

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NOTE TO THE READER: As originally submitted by the contractors this report consisted of a legal study, published in one volume and a resource study published in seven volumes. As republished by Clearinghouse the study has been combined into four volumes. Volume I consists of the legal study, Volume II contains the resource portion of the study and Volumes III and IV contain the working papers and appendices to the resources study.

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THE ECONOMICS OF FARM SIZE IN THE WESTERN UNITED STATES

by Russell L. Berry and William Folkerts

I. INTRODUCTION

How much cropland is needed to provide farm settlers with an adequate level of living? The purpose of this study is to help answer this question by a review of some of the more recent budgetary studies of farm size in the seventeen Western States. However, an answer to this question also requires the consideration of some other questions:

What is an adequate income for a farm family? The significance of alternative opportunities, the poverty level of income, and the trends in farm sizes will be explored in Part II.

In theory, how does farm size affect costs and net income of farmers? Some simple examples will be given in Part III.

Would a 160-acre homestead provide an adequate income in southern Iowa? An Iowa study of farm size will be reviewed in Part IV.

What size of irrigated farm is necessary for an adequate income? What size of dryland farm? Seven studies of irrigated farms in the West and four studies of dryland farms will be reviewed in Parts V and VI respectively. As these studies soon make apparent, there is no single size of farm that will provide an adequate income for a farm family. Farm families, like urban families, vary greatly in size and needs, and farms also vary greatly in their capacity to produce any given amount of income.

The question of how much cropland is needed to provide a farm family with an adequate income is important since there are several million acres of federal public lands that might be homesteaded under one or more of the existing homestead acts that limit the number of acres which can be acquired by settlers.

The homestead acts are a series of statutes enacted by Congress that provide for the disposal of land to farmers after certain conditions have been met. The first or original Homestead Act of 1862 provided that a

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Russell L. Berry is associate professor and William Folkerts is a graduate student in the Economics Department at South Dakota State University, Brookings. This study is part of the research being done by the University under contract with the Public Land Law Review Commission, Washington, D.C. Esther Edie prepared the data on farm size.

qualified settler could acquire 160 acres of land by living on it and cultivating it for five years. Under certain circumstances this period could also be greatly shortened or commuted by a cash payment.

Apparently it was assumed by Congress that 160 acres of land were sufficient to provide an adequate family living--that 160 acres were, in fact, an economically viable unit. There is no doubt that this was true in much of the Midwest in 1860. But as settlers pushed westward to the 100th meridian and beyond, it became quite clear that 160 acres were not enough to support a family. Hence, Congress repeatedly made efforts to enlarge the size of the homesteads allowed.

The Desert Land Act of 1877 made as many as 640 acres available for development provided the land was satisfactorily irrigated within three years. In 1890 a bill was passed to limit all entries to 320 acres west of the 100th meridian, and by 1909 the Enlarged Homestead Act permitted homesteading of 320 acres in certain Western States if the land could not be irrigated.

In 1904 the Kincaid Act, which applied only to the Sandhills area of Nebraska, permitted 640-acre homesteads. Then, in 1916 the Stock Raising Homestead Act was adopted. This Act permitted settlers to homestead 640 acres in certain Western States where the land could not be irrigated and was suited mainly for grazing and forage crops.

The Reclamation Act of 1902 permits only 160-acre homesteads on irrigated public lands, and this system continues today. Quite often the apparent intent of the law is circumvented by another member of the same family who takes up an additional 160-acre homestead. Leasing of additional irrigated land is also permitted.

Are these acreage limitations in the public interest? If so, why? If not, why not? What should be the acreage limitations, if any, if the farm family is to have an adequate income? The size of the homestead continues to be a matter of controversy and was frequently mentioned in the public hearings held by the Public Land Law Review Commission in the Western States. Hence, there is little doubt that the Commission will be expected to make recommendations regarding the size of homesteads.

The Public Land Law Review Commission was created by Congress to recommend to the President and the Congress "such modifications in existing laws, regulations, policies and practices that will, in the judgment of the Commission, best serve to carry out the policy" that "the public lands of the United States shall be (a) retained and managed or (b) disposed of, all in a manner to provide maximum benefit for the general public." The Commission, having been requested to "study existing statutes and regulations governing the retention, management and disposition of the public lands" for various purposes including intensive agriculture or dry and irrigated crop production, authorized this study to help fulfill its responsibility with regard to the size of dryland and irrigated farms.

II. WHAT IS AN ADEQUATE INCOME FOR A FARM FAMILY?

An "adequate" income is a matter of definition, and any answer is more or less an arbitrary value judgment. Yet there is some information about costs of family living which should be carefully studied before recommendations can be made with regard to the merits of present limits on farm size. Certainly, one factor affecting the adequacy of any given farm income is the amount that the farmer could make in some alternative employment opportunity that may exist for him.

Alternative Employment Opportunities and Adequate Income

In a competitive free enterprise economy, supply and demand usually determine the price paid for most goods and services, including labor. Agriculture is perhaps the most highly competitive segment of our economy, and farm labor rates for hired men are generally set by competition. But there are still many imperfections in this competition that prevent the determination of the value of a farmer's labor and management. Because he is an independent entrepreneur, his returns for labor and management are largely determined by the amount of his resources and by his skill and good fortune in managing them. Moreover, it is difficult to separate labor from management and profits since there is no direct market price for the farm operator's labor. However, one way this can be done is to assume that the operator's labor is worth at least as much as that of a hired man. Then by subtracting his labor costs as a hired man, the remainder is a return to management or profits. The following example may make this clear:

Gross farm income	$26,000
Cash farm expenses	-8,000
Net cash income	$18,000
Depreciation on machinery and buildings	-4,000
Net farm income	$14,000
Interest on investment in land, buildings and machinery	-10,000
Return to labor and management	$ 4,000
Labor at hired man's rate	3,000
Return to management (profits)	$ 1,000

This example assumes that the farm operator has the alternative opportunity of taking a job as a hired man at $3,000 a year. If so, $3,000 becomes the "opportunity cost" of his labor to the farm business. This amount may also be the farmer's alternative "opportunity returns" and

therefore his "reservation price." Unless he can make $3,000 as an independent farmer, he reserves the right to work as a hired man or take a job in town. Some farmers have the ability and training and hence, the opportunity to enter better paying jobs. Therefore, they have higher opportunity costs and probably higher reservation prices.

The foregoing example leaves unanswered the question as to whether or not a hired man's wage is adequate for a farm family. Many would argue that it is not--especially since the poverty line is generally assumed to be $3,000 in current governmental programs, and minimum wage laws are now being applied to farm labor. Certainly a hired man's rate would seem to be the minimum that any government program seeking to help farmers should observe. If the government program does not result in income sufficient to give the operator a hired man's wage for his efforts, it is doubtful whether such a program can possibly be in the public interest. The public interest is generally best served when all resources, including labor and management, are employed in their most productive manner and are compensated accordingly.

The Poverty Line and an Adequate Family Income

The President's Council of Economic Advisors has been using $3,000 as the poverty line of family income for several years. Using this line as a starting point, Madden, Pennock and Jaeger point out that the incomes needed to meet an economy food plan level for families of different sizes and characteristics vary greatly.[1] As shown in Table 1, a family consisting of only husband and wife could escape poverty with an income of $1,244 per year. If the couple has one child under six years of age $3,305 would be sufficient, and the amount needed would decline as the child became older (Types 3 and 4).

Should the poverty line be used as a guide in determining the size of farm a settler is allowed to create on federal public lands? Perhaps the minimum income for farm size determination should be one capable of supporting parents and three or four children with the oldest child over 18 years of age (Types 4 with 5-6 persons). To achieve this income the settler would have to make net returns of $5,200 a year for his labor and management. How large an acreage would be needed to provide this income? As will be shown, the answer varies from State to State and from farm to farm.

[1] J. Patrick Madden, Jean L. Pennock, and Carol M. Jaeger. "Equivalent Levels of Living: A New Approach to Scaling the Poverty Line to Different Family Characteristics and Place of Residence," in A Report by the President's National Advisory Commission on Rural Poverty, Rural Poverty in the United States, (Washington, D.C.: Government Printing Office, 1968), pp. 545-552.

Table 1.--Family incomes required by type and size of family for economy food plan level in the North Central States, 1968

Family type and size	Farm family	Urban family
Type 1 (husband and wife only)	$1,244	$1,315
Type 2 (oldest child under 6 yrs.)		
3 persons	3,305	3,895
4 persons	3,603	4,232
5 persons	3,754	4,192
6 persons	3,874	4,158
Type 3 (oldest child 6-17 yrs.)		
3 persons	2,623	3,864
4 persons	3,437	4,660
5 persons	3,889	5,040
6 persons	4,215	5,090
7 persons	4,849	5,650
Type 4 (oldest child over 18 yrs.)		
3 persons	2,501	3,365
4 persons	4,243	5,260
5 persons	5,167	6,334
6 persons	5,228	6,138
7 persons	6,358	7,278

Source: President's National Advisory Commission on Rural Poverty, Rural Poverty in the United States, (1968) p. 550.

Recent Trends in Farm Sizes in Western States

Some indication of the size of farm needed to provide an adequate income for a farm family can be secured by a study of farm sizes. In almost all of the 17 Western States the average size of farms has doubled since 1935. In four States the increase has been at least threefold (Table 2). Oklahoma had the smallest average farm size in 1964 with 407 acres. Washington was second with 418 acres and California third with 458 acres. In all the other States the size exceeded 500 acres. In six, the average size exceeded 1,000 acres. In the ranching States of Arizona, Montana, Nevada, New Mexico and Wyoming the farms averaged over 2,000 acres each. The average size in Wyoming exceeded 4,000 acres. In Nevada the average was nearly 5,000 acres and in Arizona over 6,000 acres.

These differences in size in the different States are largely explained by the quality of the land, the use of the land, the number of part-time farmers and similar factors. Land not suited or available for crop production is often used for grazing. The amount of range land needed to support a cow may vary from 10 to 100 acres depending upon its productivity. Thus even a very modest number of cows would call for hundreds or even thousands of acres of grazing land. The kinds of crops grown also affect the size of farm. Dryland crop production requires many acres of land in the Western States to support a farm family.

When the land is irrigated, crops of much greater value can be grown and more labor and management are required per acre. Hence, these farms are usually smaller.

What is an irrigated farm? The U. S. Bureau of the Census includes "all farms reporting any land irrigated." Thus a cattle or sheep ranch with a few acres of irrigated alfalfa is an "irrigated farm," and a 1,000-acre wheat farm that irrigates a few acres of crops is also an irrigated farm. Fully irrigated farms that provide full-time employment for a farm family in the Western States are about the same size as similar farms in the Midwest where the crops produced are comparable. Exceptions exist where fruits or vegetables are involved, or when the climate permits year-round cropping. However, only a small part of the irrigated land in the Western States is used for such intensive crops. Hay and pasture are the two major irrigated crops. The feed grains--sorghum, field corn and barley--are also important crops (Figure 1).

The number of irrigated farms as defined by the Bureau of the Census in the 17 Western States is shown in Table 3. In the Plains States irrigated farms make up only a small percentage of all farms, but in the Rocky Mountain States 60 percent or more of the farms have some irrigated acreage (col. 2).

Of particular interest is the size of these irrigated farms. In only three States do irrigated farms average less than 500 acres: California, 391 acres; Washington, 420 acres; and Idaho, 436 acres (col. 3). However, in only four States does the irrigated land per farm

Table 2.--Average size of farms and percentage of increase in size in the 17 Western States, by States, 1935-1964

State	1935	1950	1964	Increase (percent)
	----------	acres	----------	
Arizona	745	3,834	6,262	742
California	202	267	458	126
Colorado	471	833	1,284	173
Idaho	221	328	516	133
Kansas	275	370	544	97
Montana	940	1,689	2,436	159
Nebraska	349	423	596	71
Nevada	980	2,271	4,862	395
New Mexico	831	2,014	3,354	303
North Dakota	462	630	875	92
Oklahoma	166	253	407	145
Oregon	268	340	516	92
South Dakota	445	674	917	106
Texas	275	438	691	151
Utah	203	449	816	302
Washington	174	249	418	168
Wyoming	1,610	2,729	4,100	155

Source: U.S. Department of Commerce, Bureau of the Census, 1964 U.S. Census of Agriculture, vol. 2, chapter 3, p. 250, (figures rounded).

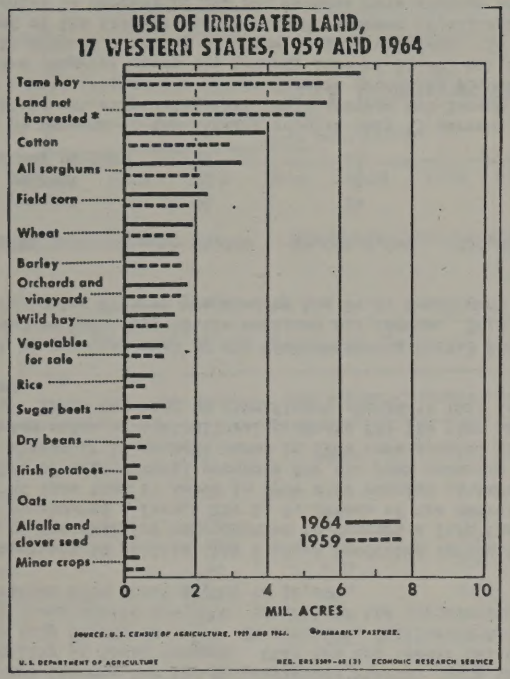


Figure 1.--Use of irrigated land in the 17 Western United States, 1959 and 1964

Table 3.--Irrigated farms in the 17 Western States, by States, 1964

State	Irrigated farms		Size of irrigated farms--acres	Irrigated land per farm--acres
	Number	Percent of all farms		
North Dakota	442	0.9	1,791	114
South Dakota	1,005	2.0	2,166	129
Nebraska	18,833	23.5	639	115
Kansas	5,102	5.5	1,186	197
Oklahoma	26,673	3.0	889	113
Texas	27,114	13.2	1,097	236
Montana	10,843	40.1	2,349	175
Idaho	22,251	75.0	436	126
Wyoming	5,923	65.5	3,510	265
Colorado	18,317	61.5	1,052	147
New Mexico	8,274	58.2	1,738	98
Arizona	4,697	72.5	4,706	240
Utah	13,762	87.3	747	79
Nevada	2,018	93.6	3,797	409
Washington	16,488	36.2	420	70
Oregon	15,869	39.9	840	101
California	59,429	73.5	391	128

Source: 1964 U.S. Census of Agriculture, vol. 2, chap. 9, pp. 915-916.

Note: An irrigated farm is defined as a farm with any portion of its acreage under irrigation.

exceed 200 acres. These are Texas, Wyoming, Arizona and Nevada. In almost all of the other States the average number of acres irrigated is less than 160. To some extent this may reflect the 160-acre limitation imposed upon all users of water supplied to federal irrigation projects.

Farm Income Estimates and Size of Farms

Another clue to what might be considered an adequate farm income is provided by average farm income estimates of the U. S. Department of Agriculture reproduced as Table 4. Presented are the realized gross farm incomes which include sales, government payments and non-monetary returns, and net incomes for the 48 contiguous States. Note particularly the variability in these incomes. Utah had the lowest net income per farm with only $2,923 in 1967. In contrast, California had nearly $12,000 and Arizona nearly $24,000. In most of the Western States the net incomes ranged from about $4,000 to $6,000.

It is important to realize that a place producing agricultural products can be too small or unproductive to support a farm family but still may be considered a farm. The U. S. Bureau of the Census states that "Places of less than 10 acres in 1964 were counted as farms if the estimated sales of agricultural products for the year amounted to at least $250. Places of 10 or more acres in 1964 were counted as farms if the estimated sales of agricultural products for the year amounted to at least $50." There has been no significant change in this definition for many years.

As might be expected many of the "farms" in the United States produce very little and so have very little realized net income. This can be seen in the following figures prepared by the U. S. Department of Agriculture.[2]

Farms with sales	Under $5,000	$5,000-9,999	$10,000 and over
All farms, percent	54	14	32
All sales, percent	7	8	85
All net income, percent	15	11	74

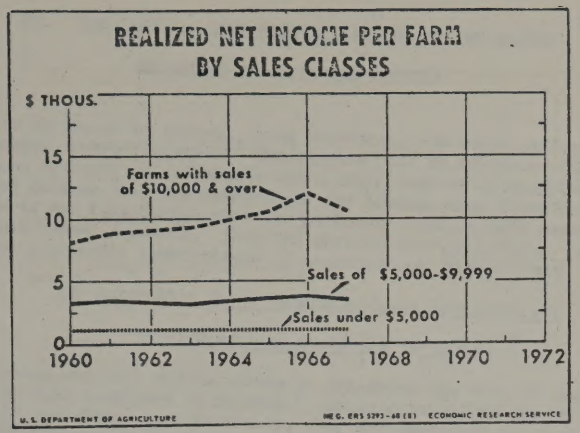
Because 54 percent of the farmers receive only 15 percent of all net income, it is not surprising that their average net income is only about $1,200 a year (Figure 2). Those farmers producing $5,000-9,999 gross sales are somewhat above the poverty line of $3,000 but do not have enough to support a family of three or more children. In contrast, the 32 percent of the farmers who produce 85 percent of all agricultural sales and receive 74 percent of the net returns have average net incomes in excess of $10,000 (Figure 2).

[2] U. S. Department of Agriculture, Farm Income Situation, no. FIS-211 (Economic Research Service, July 1968).

Table 4.--Income per farm: Realized gross and realized net, by States, 1965-1967 1/

State and region	Realized gross income 2/			Realized net income 3/		
	1965	1966	1967	1965	1966	1967
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Maine	18,947	18,268	17,168	8,191	6,020	3,705
New Hampshire	11,775	14,791	15,034	1,711	2,240	1,309
Vermont	13,009	16,091	16,735	3,828	4,692	4,654
Massachusetts	18,373	19,913	19,712	5,062	5,535	4,835
Rhode Island	19,998	20,623	20,765	3,500	3,816	2,136
Connecticut	22,975	29,970	30,671	5,973	8,918	8,078
New York	15,726	17,087	17,775	4,719	5,561	5,376
New Jersey	24,314	30,558	30,221	6,069	8,801	7,307
Pennsylvania	11,796	13,096	13,474	3,356	4,110	3,874
North Atlantic	15,048	16,666	16,951	4,444	5,146	4,661
Ohio	10,736	12,486	12,447	3,128	4,260	3,570
Indiana	12,802	15,016	14,465	4,255	5,236	4,114
Illinois	18,426	22,104	21,440	5,392	7,462	5,892
Michigan	9,564	10,928	11,221	2,958	3,717	3,396
Wisconsin	11,409	13,139	13,533	4,002	4,970	4,664
East North Central	12,863	15,070	14,939	4,022	5,243	4,410
Minnesota	13,111	15,088	15,502	3,868	4,699	4,163
Iowa	20,314	24,637	24,012	6,301	7,344	5,822
Missouri	9,466	10,585	10,564	3,298	3,790	3,273
North Dakota	16,844	18,790	18,945	5,430	6,569	5,933
South Dakota	16,670	19,442	19,591	5,206	6,529	6,001
Nebraska	19,260	23,978	24,156	4,903	6,710	6,048
Kansas	14,910	18,772	18,681	3,619	6,036	5,259
West North Central	15,325	18,153	18,124	4,559	5,714	4,922
Delaware	27,544	30,542	32,724	7,507	7,530	8,461
Maryland	16,387	17,831	18,501	4,496	4,508	4,533
Virginia	7,313	7,771	8,272	2,390	2,367	2,443
West Virginia	3,789	4,057	4,225	935	967	855
North Carolina	7,265	8,596	8,710	2,980	3,691	3,636
South Carolina	7,356	8,315	9,078	2,769	3,307	3,655
Georgia	12,506	14,126	14,656	4,530	5,155	5,033
Florida	27,173	28,328	29,768	11,411	11,330	11,051
South Atlantic	9,960	11,171	11,613	3,702	4,151	4,139
Kentucky	5,796	6,165	6,633	2,400	2,482	2,730
Tennessee	4,994	5,409	5,514	1,921	1,903	1,815
Alabama	7,568	8,184	8,040	2,802	2,879	2,534
Mississippi	8,546	9,625	10,277	3,547	4,155	4,498
Arkansas	12,665	13,900	13,067	4,649	5,451	4,225
Louisiana	8,742	10,783	12,361	3,328	4,643	5,452
Oklahoma	10,527	11,757	11,510	3,387	4,001	3,486
Texas	14,003	16,367	15,630	4,463	6,070	5,010
South Central	9,164	10,402	10,428	3,288	3,956	3,654
Montana	16,645	20,299	21,214	4,768	6,980	6,631
Idaho	15,923	17,427	17,606	4,574	5,390	4,886
Wyoming	20,157	24,979	25,103	3,606	6,589	6,034
Colorado	24,109	29,001	29,204	3,407	4,863	3,817
New Mexico	20,069	23,441	23,454	6,004	8,689	8,143
Arizona	79,656	88,215	92,633	21,457	22,826	23,650
Utah	12,300	14,130	14,163	2,205	3,210	2,923
Nevada	27,718	32,767	33,291	3,877	7,499	7,163
Washington	14,611	17,116	18,444	4,416	5,818	6,417
Oregon	12,430	13,913	14,820	3,292	4,000	4,160
California	42,739	50,035	51,551	9,853	12,461	11,857
Western Region	24,991	28,796	29,586	5,995	7,677	7,367
United States	13,264	15,289	15,415	4,109	5,049	4,573

1/ Data for 1967 are preliminary. 2/ Excludes changes in inventories. 3/ Excludes changes in inventories, and represents income of farm operators. Source: Farm Income Situation, no. FIS-209, p. 18



Realized net income per farm, by sales classes, 1960-67

Year	Farms with sales--		
	Under $5,000	$5,000 to $9,999	$10,000 and over
	Dollars		
1960	1,128	3,305	8,093
1961	1,189	3,501	8,969
1962	1,165	3,422	9,098
1963	1,140	3,319	9,241
1964	1,198	3,477	9,846
1965	1,208	3,542	10,617
1966	1,296	3,881	12,027
1967	1,229	3,585	10,619

Data from Farm Income Situation, July 1968 (ERS).

Figure 2.--Realized net income per farm, by sales classes, 1960-67

How much should a farm produce for sale in order to realize a net income of $5,000? Since farm costs have been averaging about 70 percent of gross farm income, it appears that the gross should be about $16,000 per farm. In 1967 the average farmer produced somewhat less than this according to the U.S. Department of Agriculture:[3]

Realized gross farm income	$15,415
Farm production expenses	10,842
Realized net income	$ 4,573
Inventory change	132
Total net income	$ 4,705

How many acres would be needed to produce $16,000 gross income? If $100 gross could be produced per acre, then 160 acres would be needed. A gross income of $100 per acre would be a high return even in the Corn Belt unless specialty crops or much livestock were produced. Dryland farming in the Western States would not usually produce more than $25 an acre and so would require 640 acres of cropland to produce a $16,000 gross income.

Irrigated farms producing cotton, sugar beets and other high value crops might gross as much as $160 an acre or more and thus require only 100 acres to produce a gross income of $16,000. However, expenses on such a small farm may run high because of irrigation costs and a net income of $5,000 or more might not be realized.

Only by making complete farm budgets for a specific area can an accurate idea of the amount of land needed for any given income be determined. Therefore, several budgetary studies of farm size will be reviewed in this report.

Farms for the Future: Projections for 1980

Past trends in farm size are helpful in determining the size of farm needed. However, the future also needs to be explored. What would be the size of farms and ranches if all were organized as were the most efficient in 1959? A study by Saupe and Kaldor gives an answer to this question for the North Central Region which includes four of the 17 Western States--North Dakota, South Dakota, Nebraska and Kansas.[4] The results of their analysis for North Dakota and South Dakota are presented in Table 5. In

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[3] U.S. Department of Agriculture, Farm Income Situation, no. FIS-209 (Economic Research Service, February 1968), p. 4.

[4] William E. Saupe and Donald R. Kaldor, "Efficient Organization of the Farm Industry in the North Central Region of the United States in 1980, mimeographed (Iowa State University, Department of Economics and Sociology, 1965).

Table 5.--Changes in number and size of farms if all farms were reorganized as the most efficient were in 1959

Census economic subregions	Number of farms			Size of farms, acres		
	1959	Reorganized	Change (percent)	1959	Reorganized	Change (percent)
South Dakota						
West River	7,400	3,000	-60	2,800	6,900	145
North	12,000	4,400	-63	840	2,200	163
South	12,200	2,800	-77	530	2,300	333
Northeast	8,000	2,300	-71	400	1,300	235
Southeast	10,100	2,300	-77	260	1,100	316
North Dakota						
West River	8,700	1,800	-79	1,200	5,600	370
Central	34,100	10,300	-70	760	2,500	227
East	7,600	3,500	-54	530	1,100	115

Source: Saupe and Kaldor, "Efficient Organization of the Farm Industry," Supplementary tables.

Note: Numbers of farms and acres are rounded. Hence percentages may not agree.

North Dakota the increase in size would range from 115 percent in the eastern area of the Red River Valley to 370 percent in the western area. In South Dakota the adjustment would range from 145 percent in the western area to 316 percent in the southeast. The average size of farms in the two Dakotas would be 1,100 acres in the eastern areas, 2,200 acres in the central areas and 5,600 to 6,900 in the western areas.

Saupe and Kaldor estimate that these organizational changes would reduce the amount of labor required in all areas of the two Dakotas from 3 to 37 percent. To replace this labor and to get the job done, the investment in machinery and livestock would be greatly increased. The increases would vary by areas but would range from 70 to 280 percent.

The total capital requirement (including land) would approach one-quarter million dollars. The increase in capital would vary by areas but would range from 222 to 431 percent. Factor earnings would increase remarkably. They would range from 244 to 1,783 percent. It should be emphasized that these are not predictions of what will result by 1980 but of what could happen if the assumptions used in the study were realized.

Brake has estimated for the United States that the number of farms will decrease 38 percent by 1980, and real estate investment for the average farm in the United States will increase from $47,200 in 1965 to $119,400 by 1980--or 254 percent.[5] He also estimates that total assets, including land, livestock and machinery will increase 240 percent by 1980.

The significant point about these projections is that they emphasize the trends already noted in farm size, and they help make clear the great difficulty that exists in any attempt to determine for the future the minimum size of farm needed for an adequate income.

[5] John R. Brake, "Impact of Structural Changes on Capital and Credit Needs," Journal of Farm Economics 48, no. 5 (December 1966), p. 1541.

III. THE THEORY: SOME SIMPLE EXAMPLES OF THE EFFECT OF OUTPUT ON COSTS AND RETURNS

How do the miles driven, acres harvested, and output affect ownership costs? Operating costs? The purpose here is to answer these questions by using an automobile and a grain combine as examples. These are used because they are commonplace and because they illustrate what happens to net farm income when the machinery used is held constant and the acres farmed increase. They can also be used as examples to explore the most profitable combinations of machinery and size of farm.

Why Automobile Total Ownership Costs Are Fixed and Total Operating Costs Are Variable

Stevens and Fehr made a survey to determine the cost of owning and operating farm machinery in Wyoming.[6] While automobiles are not generally considered farm machinery, they are necessary for a great many tasks essential to the farm business. One of these is transportation for the farm manager when he shops for farm inputs such as feeds, seeds, livestock, and machinery repairs. The yearly ownership costs of an automobile, or any machine, include depreciation, interest on investment, taxes and license fees, insurance, and housing. These costs vary with the purchase price and age of the machine as shown by the Stevens and Fehr study in which 93 farm autos are divided into two groups on the basis of value/age as follows:

Fixed costs	Older cars	Newer cars	Average (all cars)
Depreciation	$339	$691	$424
Interest on investment	59	138	85
License and taxes	28	46	36
Insurance	64	70	66
Housing	12	46	44
Total ownership costs	$502	$991	$656

These yearly ownership costs are said to be fixed costs because the total does not vary regardless of the miles driven. Thus the ownership costs of the "average auto" in each of the three groups are fixed, or constant, regardless of the miles driven:

[6] Delwin M. Stevens and Allen H. Fehr, Jr., Cost of Owning and Operating Farm Power and Machinery on Dryland Farms in Wyoming, Wyoming Agricultural Experiment Station Bulletin 420 (1964), p. 31.

Miles driven yearly	Older cars	Newer cars	Average (93 autos)	Example auto
5,000	502	991	656	800
10,000	502	991	656	800
20,000	502	991	656	800

The "example auto" in the last column with total fixed costs of $800 is included to simplify the explanation of costs to follow.

Why is it these ownership costs are fixed? They are fixed because the price paid for the car is fixed. The fixed price results in fixed depreciation, fixed interest on investment, fixed license fees and taxes, fixed insurance and housing costs. The costs are all fixed regardless of miles driven although they may vary in some other respects. For instance, the cost of license plates may differ from State to State. Different depreciation and interest rates may be used. But once these rates are set, they do not vary with the miles driven.

In addition to fixed ownership costs, the automobile has operating costs that do vary or increase as the miles driven increase. Such operating costs are called variable costs. The most important of these variable costs are gasoline, oil, and grease. Tires may also be regarded as a variable cost. Repairs are another important variable cost of an automobile and most machinery, but some repairs which must be made whether the machinery is used or not may be regarded as fixed costs--paint is an example.

Usually these auto operating costs average about 3.5 cents per mile, but the total cost varies with the total miles driven. How total variable cost increases as miles driven increase is shown by the following figures (we use $0.04 per mile for simplicity):

Miles driven yearly	10,000	20,000	40,000
Average variable costs	$0.04	$0.04	$0.04
Total variable costs	400.00	800.00	1,600.00

By adding total variable costs and total fixed costs the total cost of operating this hypothetical automobile can be secured as follows:

Miles driven yearly	10,000	20,000	40,000
Total fixed costs	$ 800	$ 800	$ 800
Total variable costs	400	800	1,600
Total costs	1,200	1,600	2,400

All three sets of these auto costs can be presented graphically (Figure 3). Note that the total fixed costs are $800 even if the auto is not driven. Variable costs start at zero and increase as miles driven increase. By placing the wedge-shaped variable costs on top of the fixed costs, total costs are also shown.

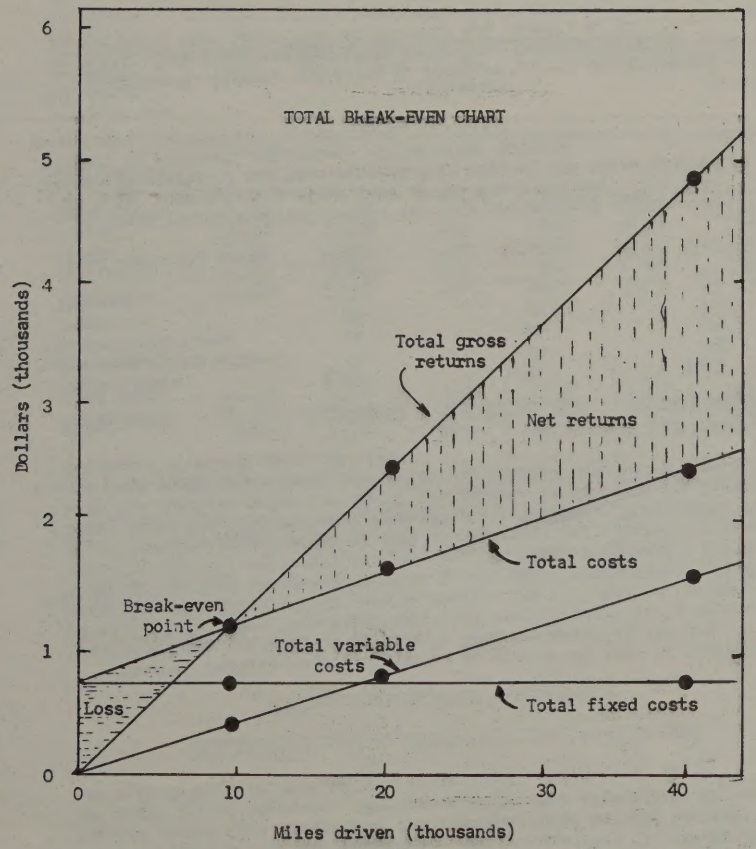

Figure 3.--Break-even chart showing total costs and total net returns for various distances driven (hypothetical data)

Suppose now that the auto can be rented out for $.12 a mile. Then the total returns less total costs would give net returns as shown in the following figures:

Miles driven yearly	10,000	20,000	40,000
Returns per mile	$ 0.12	$ 0.12	$ 0.12
Total gross returns	1,200	2,400	4,800
Total costs	1,200	1,600	2,400
Net returns	0	800	2,400

The "total gross returns" have been plotted on Figure 3 and the points connected by a straight line. As a result, the "net returns" for any mileage can be seen at a glance as the vertical distance between the total cost and total gross return lines. The break-even point is at 10,000 miles where the $1200 returns are just matched by $1200 of costs. When fewer miles are driven the total returns are less than total costs. When mileage is above 10,000, net returns are made. An advantage of the break-even chart is that the costs and returns for any mileage driven can be readily determined without further calculation. For example, if the auto is driven 30,000 miles at the rental rate given, the net returns can be seen at a glance.

This break-even chart also shows the importance of total fixed costs. If there were no fixed costs, then net returns would be the difference between total variable costs and total returns. The auto owner would break even at zero miles! And if the total fixed costs were doubled (increased by $800) the break-even mileage needed would also be doubled--shifting from 10,000 to 20,000 miles. Such an $800 increase in fixed costs would "lift" the total cost line by the same amount without changing its slope. As a result, the cost-price squeeze would eliminate the net returns shown at 20,000 miles, and this would be the new break-even point.

Now suppose the auto owner decides to operate a one-cab taxi service instead of a one-car rental agency. If his total costs remained the same as shown in Figure 3, what rate would he have to charge and how many miles would he have to drive to make his cab driving an attractive alternative to working in a factory or at some other job?

Suppose the car owner can make $5,600 a year at other work equally as attractive as driving a cab. Suppose that he can make $.36 per cab mile by charging $1.25 per passenger mile. How many miles would he have to drive at this rate to match his opportunity returns? The possibilities can be explored as follows:

Miles driven yearly	10,000	20,000	40,000
Total gross returns	$3,600	$7,200	$14,400
Total costs	1,200	1,600	2,400
Net returns	2,400	5,600	12,000

These figures show that the cab would have to average $.36 a mile for 20,000 miles to give the owner-operator $5,600 net returns for his labor and management. He would have to drive 200 days at the rate of 100 miles per day, and 28 percent of the miles would have to be passenger miles at $1.25 per mile if he is to realize total gross returns of $.36 per mile. Other rates and net return possibilities can be explored by changing the slope of the total returns line in Figure 3.

Considerable time has been spent in explaining the break-even chart because this technique will be used as much as possible for exploring the minimum size of farm necessary to produce an adequate income on dryland and irrigated farms that might be developed on federal public lands in the Western States.

Why Average Total Costs Fall as Use Increases

The easiest way to determine the size of farm needed to provide an adequate income is to work with total costs as previously explained. However, most of the studies reviewed use average costs per acre or per unit of product or per dollar of product, and these costs require explanation.

The example auto had ownership costs of $800 that were total fixed costs for the year. But the average fixed cost per mile falls as more miles are driven. For example:

Miles driven yearly	10,000	20,000	40,000
Total fixed cost	$800	$800	$800
Average fixed cost per mile	0.08	0.04	0.02

The "average fixed costs" line in Figure 4 shows how rapidly these costs fall as the miles driven increase. This curve illustrates the general rule that every time the miles driven are doubled, the fixed costs of ownership fall by half. This rule applies not only to automobiles but also to tractors, plows, cultivators, corn pickers, and combines and is therefore relevant for all farmers and other businessmen. The more acres the farmer can cover with a fixed set of machinery the lower his average fixed cost per acre or per bushel. There are no exceptions to this rule so long as the total ownership costs remain fixed. This is the main reason why farmers seek more acres and higher yields or both. The more they can produce with a given set of total fixed costs, the lower their cost per unit produced, and the more likely they will be to make profits.

It should be carefully noted that the average fixed costs of an automobile fall by $0.04 per mile when the mileage is increased from 10,000 to 20,000 but by only $0.02 when it is increased from 20,000 to 40,000 miles. This change in rate can be clearly seen in Figure 4. Thus the slope of the average fixed cost line reveals a second important rule: average fixed costs fall very rapidly at first, then slower and slower as use increases. This rule applies to all fixed costs of a farmer or other

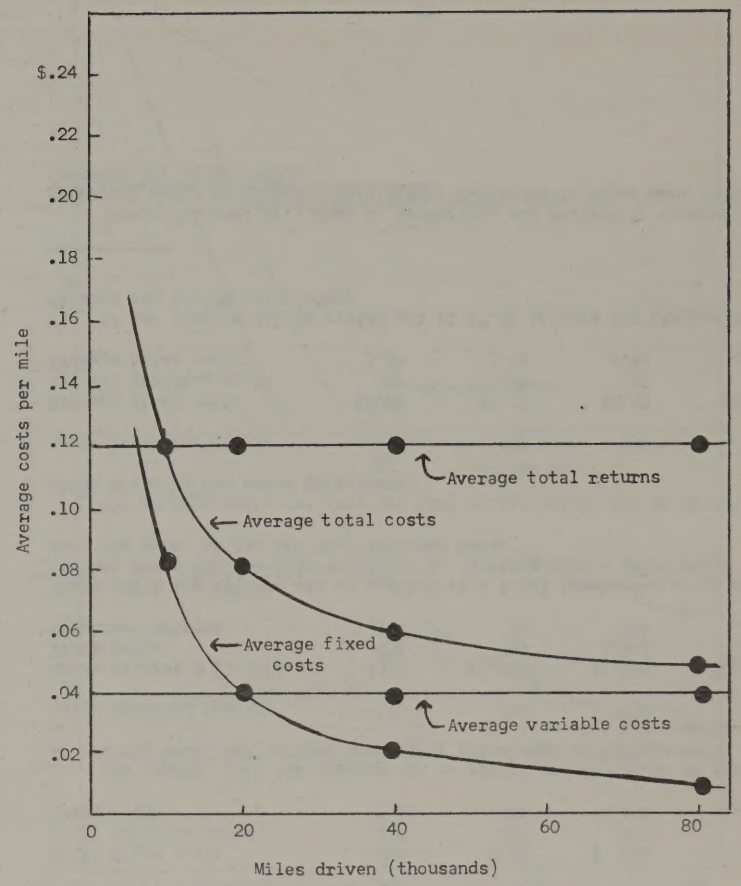

Figure 4.--Average costs per mile of automobile ownership and operation

businessman and helps explain why farmers--once they get off the steep portion of their cost curve--show little interest in further expansion.

Average variable costs are also easily calculated by dividing the total variable costs by the miles driven:

Miles driven yearly	10,000	20,000	40,000
Total variable cost	$400	$800	$1,600
Average variable cost	0.04	0.04	0.04

When the identical variable costs of $.04 are plotted on the graph, the result is obviously a straight horizontal line regardless of the miles driven.

Average total costs are secured by adding average fixed costs and average variable costs as follows:

Miles driven yearly	10,000	20,000	40,000
Average fixed costs	$0.08	$0.04	$0.02
Average variable costs	.04	.04	.04
Average total costs	.12	.08	.06

If the auto owner rents the auto out at $.12 per mile, then his average net return per mile for various mileages driven can be found by subtraction:

Miles driven	10,000	20,000	40,000
Average total return per mile	$0.12	$0.12	$0.12
Average total costs	.12	.08	.06
Average net returns	.00	.04	.06

These figures are shown graphically in Figure 4. The advantage of this graph is that the average costs and returns for <u>any mileage</u> up to 80,000 miles can be read directly.

While Figure 4 suggests that costs would continue to fall up to 80,000 miles or more, this probably would not occur. Average variable costs probably would increase beyond 40,000 miles. The engine would use more oil, the miles per gallon of fuel might decrease, and more repairs would be needed. When the car is being repaired, it could not be leased out at $.12 per mile. Finally, the car would have to average 40 miles an hour for an eight hour day for 250 days a year, if it were to be driven 80,000 miles. It is unlikely that it would be used for more than 60,000 miles per year.

Like the automobile, the tractor, the self-propelled combine, and other machinery also have their fixed and variable costs. Fixed costs include depreciation, insurance, taxes, and interest. Variable costs

include repairs, fuel, oil, and lubricant; and the sum of fixed and variable costs are total costs. Average costs are secured by dividing the total costs by the acres covered, bushels threshed, and so on.

Ullrich and others have calculated the costs of a typical 15-foot combine such as is often used in the West to harvest grain crops.[7] Their <u>total</u> costs were as follows:

Acres harvested yearly	150	300	450	600
Total fixed costs	$696	$696	$ 696	$ 696
Total variable costs	135	270	405	540
Total costs	831	966	1,101	1,236

Now suppose that the combine can be rented out for $3.50 an acre. If so, the total net returns are easily calculated as follows:

Acres combined yearly	150	300	450	600
Gross returns @ $3.50/A.	$525	$1,050	$1,575	$2,100
Total costs	831	966	1,101	1,236
Total net returns	(-306)	84	474	864

These costs and returns can be plotted as a total break-even graph similar to that shown for the auto in Figure 3. Because such a graph would be much the same, it has not been included here.

The <u>average</u> costs per acre are also easily calculated by dividing the total costs by the acres harvested:

Acres harvested yearly	150	300	450	600
Average fixed costs	$4.64	$2.32	$1.55	$1.16
Average variable costs	.90	.90	.90	.90
Average total costs	5.54	3.22	2.45	2.06

If the combine can be rented out at $3.50 an acre the <u>average</u> net returns are easily calculated:

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[7] Erwin Ullrich, Jr., John T. Sanderson, and Wallace G. Aanderud, <u>Machinery Costs on Typical Wheat Farms</u>, South Dakota Experiment Station Circular 187 (July 1968).

Acres combined yearly	150	300	450	600
Gross returns per acre	$3.50	$3.50	$3.50	$3.50
Average total costs per acre	5.54	3.22	2.45	2.06
Average net returns per acre	-2.04	0.28	1.05	1.44

These average costs and returns are presented in Figure 5. Note that average fixed costs and average total costs fall as more acres are harvested just as these costs fall for an automobile when more miles are driven. Again, the rapidity with which they fall is more readily seen when they are presented as a graph (Figure 5). The lowest total cost per acre is achieved when 600 acres are harvested. This assumes the operator can cover 40 acres a day for 15 days, a rate which does not seem unreasonable. Of course, the acreage that can be harvested depends on a number of factors such as terrain, climatic conditions, shutdown time and the operator's competence.

Can the farmer afford to own this $6,000 combine? If he can hire his crop custom combined for $3.50 an acre, then he would need to have about 290 acres to get his total costs down to the custom rate. This is shown by the average break-even point in Figure 5. This break-even point also indicates that if the combine were bought for custom work, 290 acres would have to be harvested at $3.50 an acre just to break even. However, if the combine operator wanted to know how many acres he would have to combine to make a total of $500, the total costs and returns will give him a more direct answer, particularly if he uses a chart like Figure 3 for the automobile.

Average cost curves are most useful when the object is to determine the minimum or least cost per bushel, or other unit or product, or per dollar of product. But to determine this least cost, accurate information is needed on what happens to crop yields when a farmer attempts to farm more and more acres with a fixed amount of machinery. Otherwise there is no way of knowing just where the average costs curves will start to turn up and thus indicate the least cost or the most profitable acreage. Very little information of this nature is available--only three of the studies reviewed included such analyses. The Iowa Experiment Station appears to have done the most work on this problem, and their costs curve per dollar of product does reveal a least cost point. This may be seen in Figure 6 for the Ihnen and Heady study that is discussed later in this review of farm size studies (see p. 28).

Unfortunately, unit costs cannot be used to decide whether or not federal public lands should be brought into production since all the profits are absorbed when charges are entered for labor, management and land. Because average total costs on lands of different productivity tend to equal the price of the product, they are not helpful in determining which lands should, or should not, be farmed. Therefore, while some

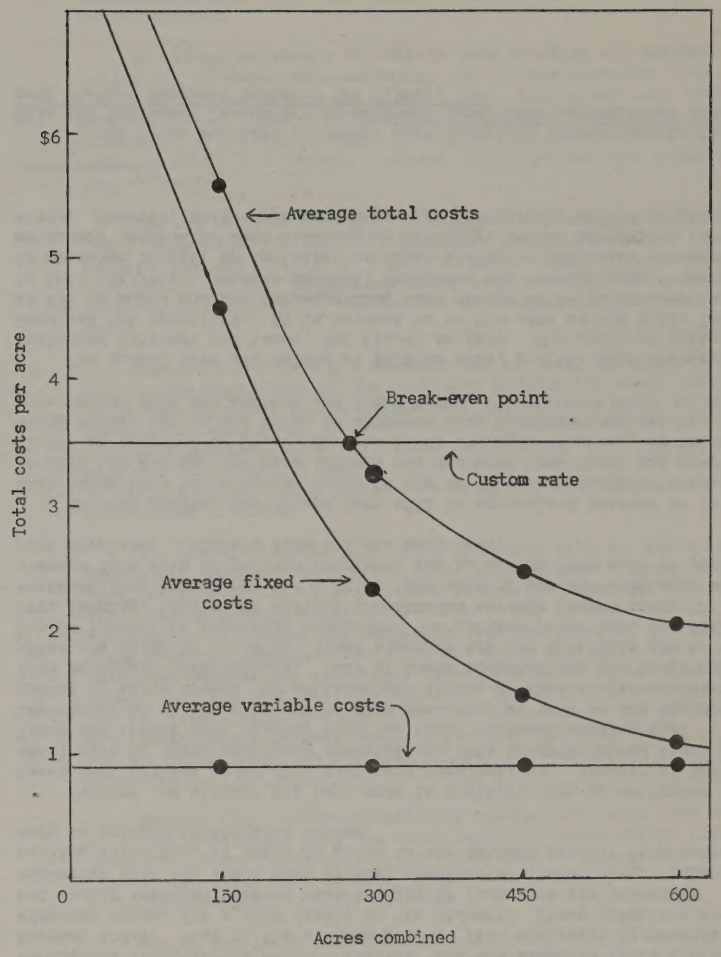

Figure 5.--Average costs per acre of owning and operating a self-propelled grain combine

average costs will be presented, total farm costs and returns will be used in this study to determine how much cropland is needed to provide a family with an adequate farm income.

An automobile and a grain combine have been used as examples to explain the nature and importance of fixed and variable costs. However, fixed and variable costs behave in exactly the same way for trucks, tractors and other machinery, or machinery combinations, of a farmer or businessman. The points made may be summarized as follows:

1. Total ownership costs are called fixed costs because they do not vary regardless of the miles driven, acres farmed, bushels produced, etc.

2. Because total ownership costs are fixed, average ownership costs fall as they are spread over more miles, acres, or bushels. It is important then that the high fixed costs be spread over as many units as is practical so that unit costs are reduced, and net returns are increased.

3. Total operating costs vary with miles driven, acres farmed, bushels produced, etc., and therefore are called variable costs. Specifically, an operating cost like gasoline increases in direct proportion to the miles driven, or acres farmed, even though the average cost per gallon remains the same.

4. Fixed costs determine the location of the break-even point and so are very important factors affecting the miles that must be driven, or acres farmed, if the operator and his family are to be assured an adequate income.

IV. THE HOMESTEAD IN THE MIDWEST--IS IT STILL ADEQUATE?

The original Homestead Act of 1862 was designed for the Midwest, and it should not be surprising to find it unsuited for the less favorable conditions found in the Western States. But how adequate is it for the Midwest today? What is the minimum size of farm necessary to provide an adequate income for a farm family in the Midwest? These questions are not easily answered because most studies of farm size are primarily concerned with the least cost or most profitable size of farm. Only passing attention, if that, is given to the minimum size of farm necessary to provide an adequate income.

However, an attempt has been made in southern Iowa to determine the least cost acreage under five machinery combinations. Because of the small size of these machinery combinations this study by Ihnen and Heady may reveal more clearly than the other reviewed studies the importance of an adequate set of farm machinery as well as the minimum number of acres needed for satisfactory living.[8] This study considers five machinery combinations. Four of these combinations and their new price are given in Table 6. Since tractors are not divisible and a 2-plow tractor is generally considered the minimum power unit for field-crop farming, this study reveals the minimum acreage needed under southern Iowa conditions for a hilly farm with 32 percent cropland, an average farm with 40 percent cropland, and an upland farm with 70 percent cropland. Complete farm budgets were used.

In this review, the upland farm will be emphasized because it is most comparable to irrigated farms in use of land and yields of crops. In 1954 the average net farm incomes for southern Iowa farms was only $1,500 as compared to $4,100 for the State average. However, as this study shows, the upland farms in southern Iowa produced considerably more income than the average and hilly farms.

The upland farm was valued at $222 an acre, and the land charge, including interest and taxes, was $14.43 an acre. The price of pasture land was not specified. It is assumed to be the same as the hilly land or $72 an acre, and the corresponding land charge of $4.70 an acre is used in this analysis. Because rainfall furnished the "irrigations," there is no water charge, no sprinkler or ditch system to maintain, no special machinery needed for land leveling or ditching, and no irrigation labor costs. However, these cost advantages are undoubtedly offset in part by

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[8] Loren Ihnen and Earl O. Heady, Cost Functions in Relation to Farm Size and Machinery Technology in Southern Iowa, Iowa Agricultural Experiment Station Research Bulletin 527 (1964).

Table 6.--Five machinery combinations used in Iowa study

1. Machines and prices in the 2-plow machinery combination.

Machines	Purchase price
Tractor, 2-plow	$ 2,695
Fertilizer spreader, 12'	380
Plow, 2-14"	267
Tandem disc, 7'	298
Harrow, 20'	188
Endgate seeder	99
Planter, 2-row	400
Rotary hoe, 2-row	216
Cultivator, 2-row	273
Combine, 6' motor driven	2,283
Corn picker, 1-row mounted	1,253
Mower, 7'	371
Side delivery rake, 7'	440
Baler, motor driven	2,058
Wagon	568
Elevator, 40'	1,053
Total purchase cost	$12,842

2. Machines and prices in the 2-plow, 2-plow machinery combination.

Machines	Purchase price
Tractor, 2-plow	$ 2,695
Tractor, 2-plow	2,695
Fertilizer spreader, 12'	380
Plow, 2-14"	267
Plow, 2-14"	267
Tandem disc, 7'	298
Tandem disc, 7'	298
Harrow, 20'	188
Endgate seeder	99
Planter, 2-row	400
Rotary hoe, 2-row	216
Rotary hoe, 2-row	216
Cultivator, 2-row	273
Cultivator, 2-row	273
Combine, 6' motor driven	2,283
Corn picker, 1-row mounted	1,253
Mower, 7'	371
Side delivery rake, 7'	440
Baler, motor driven	2,058
Wagon	568
Wagon	568
Elevator, 40'	1,053
Total purchase cost	$17,159

3. Machines and prices in the 3-plow machinery combination.

Total purchase cost	$15,322

4. Machines and prices in the 2-plow, 3-plow machinery combination.

Machines	Purchase price
Tractor, 3-plow	$ 3,425
Tractor, 2-plow	2,695
Fertilizer spreader, 12'	380
Plow, 3-14"	434
Plow, 2-14"	267
Tandem disc, 10'	410
Tandem disc, 7'	298
Harrow, 25'	237
Endgate seeder	99
Planter, 4-row	759
Rotary hoe, 4-row	433
Cultivator, 4-row	626
Cultivator, 2-row	273
Combine, 7' P.T.O.	2,109
Corn picker, 2-row mounted	2,208
Mower, 7'	371
Side delivery rake, 7'	440
Baler, P.T.O.	1,770
Wagon	568
Wagon	568
Elevator, 40'	1,053
Total purchase cost	$19,639

5. Machines and prices in the 3-plow, 3-plow machinery combination.

Machines	Purchase price
Tractor, 3-plow	$ 3,425
Tractor, 3-plow	3,425
Fertilizer spreader, 12'	380
Plow, 3-14"	434
Plow, 3-14"	434
Tandem disc, 10'	410
Tandem disc, 10'	410
Harrow, 25'	237
Endgate seeder	99
Planter, 4-row	759
Rotary hoe, 4-row	433
Rotary hoe, 4-row	433
Cultivator, 4-row	626
Cultivator, 4-row	626
Combine, 7' P.T.O.	2,109
Corn picker, 2-row mounted	2,208
Mower, 7'	371
Side delivery rake, 7'	440
Baler, P.T.O.	1,770
Wagon	568
Wagon	568
Elevator	1,053
Total purchase cost	$21,218

Source: Ihnen and Heady, Cost Functions.

weather risks. As will be seen, the corn yield of 59 bushels an acre is considerably less than that assumed under irrigation in some of the studies to be reviewed.

On the upland farm a three-year crop rotation was assumed to be used consisting of corn--corn--soybeans. No hay was produced. Hay needed for the beef herd was purchased at $14 a ton. Yields per acre used in the budgets were 59 bushels of corn and 26 bushels of soybeans. Long run historical price relationships were used with corn at $1.00 a bushel and soybeans at $1.91 a bushel. Current (1963) prices were assumed for purchased inputs.

The net returns to labor and management (including any hired) are shown in Table 7. Of the five machinery combinations, only the three largest show net returns of $3,000 or more. Least cost acreages were used even though the two largest machinery combinations could have farmed 380 acres without increasing per acre or per bushel costs by more than 5 percent.

Because a constant mix of crops was assumed, the gross returns were $56 an acre regardless of the machinery combination used. And since the crops were produced in a constant mix, the variable costs of crop production for such items as seeds, fuel, fertilizers and so on were also virtually constant. The variations in machinery repair costs and fuel were not sufficient to make a dollar of difference in the variable costs of crop production, and they were rounded off at $31 an acre regardless of the size of farms.

The amount of labor also varied somewhat with the machinery combination used. However, both hired labor and operator's labor were subtracted from variable costs. This was done because an important objective of this study was to determine the net returns to the operator for his labor and management. His labor and management and the labor of his family should claim whatever remains after all other costs are paid. Labor was also taken out because the operator's labor, the labor of his family, and any hired labor are difficult to separate. Therefore, net returns are returns for all labor (including any hired) and management. If the operator and his family cannot perform the labor, then hired labor would be necessary, and the returns for the operator's labor and management would be reduced accordingly.

Because five different machinery combinations were used in this study it is not surprising that the fixed ownership costs differ (Table 7). Because of these differences, the least cost acreages shown on the second line of the table also differ. As a result, the total net returns to all labor and management differ as shown.

Why do the least cost acreages differ for these five machinery combinations? They differ simply because the smaller the set of machinery, the smaller the acreage that can be planted during the short and critical

Table 7.--Net returns to labor (including hired) and management with five machinery combinations used on least-cost acreages, upland farms, southern Iowa, 1963

Machinery combinations	2-plow	3-plow	2-plow 2-plow	2-plow 3-plow	3-plow 3-plow
Machinery (new cost)	$12,800	$15,300	$17,200	$19,600	$21,200
Cropland, least-cost acres	120	160	200	280	320
Total acres (includes pasture)	160	213	266	373	427
Total returns @ $56 an acre	$ 6,720	$ 8,960	$11,200	$15,680	$17,920
Total variable costs @ $31 an acre	3,720	4,960	6,200	8,680	9,920
Total fixed costs, machinery	1,370	1,710	1,910	2,240	2,440
Total costs	5,090	6,670	8,110	10,920	12,360
Total net returns to labor and management[a]	1,630	2,290	3,090	4,760	5,560
Average total cost per acre	$42.40	$41.69	$40.55	$39.00	$38.62
Average net returns per acre	13.60	14.31	15.45	17.00	17.38

Source: Ihnen and Heady, Cost Functions in Relation to Farm Size (reproduced and derived data).

[a]Does not include returns from pasture or livestock.

planting season. Failure to get the crops planted or cultivated at the right time means lower yields, and lower yields mean higher costs per bushel produced or dollar of product produced. Therefore, the average total costs curves begin to rise beyond the least cost acreages shown on the second line of Table 7.

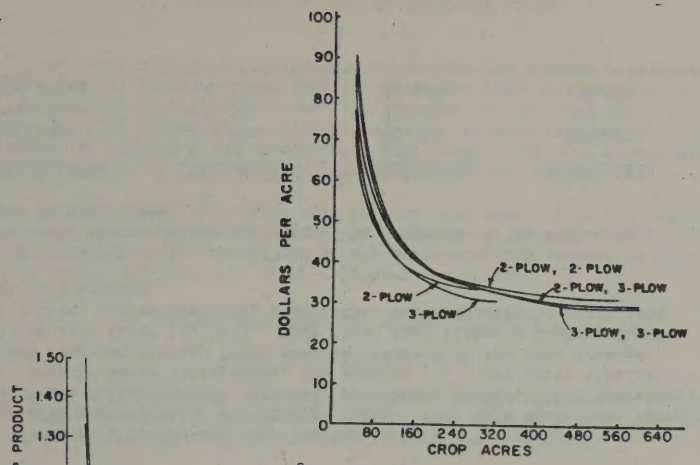
What happens to average total costs per dollar of product for these five machinery combinations is clearly shown in Figure 6. The smaller the machinery combination the faster the average total cost curve falls, but the sooner it begins to rise. The smallest begins to rise beyond 120 acres, the next smallest beyond 160 acres and the largest beyond 320 acres of cropland.

What would be the effect of holding constant the fixed costs of machinery, and varying the acreage farmed? This question is important and will be explored in the discussion of most of the studies to be reviewed. The minimum practical investment in machinery will be determined, and then this fixed cost will be spread over more acres to show the effects on returns to labor and management. For example, if the 2-plow, 2-plow combination is deemed to be the smallest practical machinery combination, what would be the effect on net returns if 250 or 300 acres could be farmed without a reduction in yields? The effect of these added acres can be seen in the following figures:

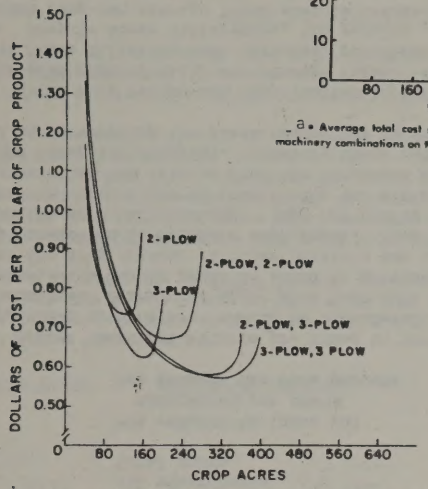
Acres of cropland	200	250	300
Total returns gross	$11,200	$14,000	$16,800
Total fixed costs	1,910	1,910	1,910
Total variable costs	6,200	7,750	9,300
Total costs	8,110	9,660	11,210
Net returns	3,090	4,340	5,590

These figures indicate that if the farmer could operate 300 acres with this machinery combination he would have a much better return for his labor and management. However, it is important to recognize that yields might fall, and certainly more labor would be needed. Unless the yields can be maintained at a high level and the labor can be provided by the family, the gains might be much less than these figures suggest. Ihnen and Heady indicate that about 380 acres can be farmed by this machinery combination without more than a 5 percent decrease in returns due to declining yields caused by lack of timely field operations.

Assuming that yields can be maintained, the net returns that might be secured with a 2-plow, 2-plow machinery combination for any acreage can be seen in Figure 7. Net returns are shown not only for 200, 250, and 300 acres of cropland, but also for other acreages. The vertical distance between the total cost line and the total return line indicates the net return under the assumptions used in this study.



a. Average total cost per crop acre with no crop losses for selected machinery combinations on the average farm.



b. Average total cost per dollar of crop product by farm size for selected machinery combinations on the upland farm.

Figure 6.--Comparison of average cost per acre and average cost per dollar of product on southern Iowa farms

Source: Ihnen and Heady, Cost Functions, pp. 134, 141

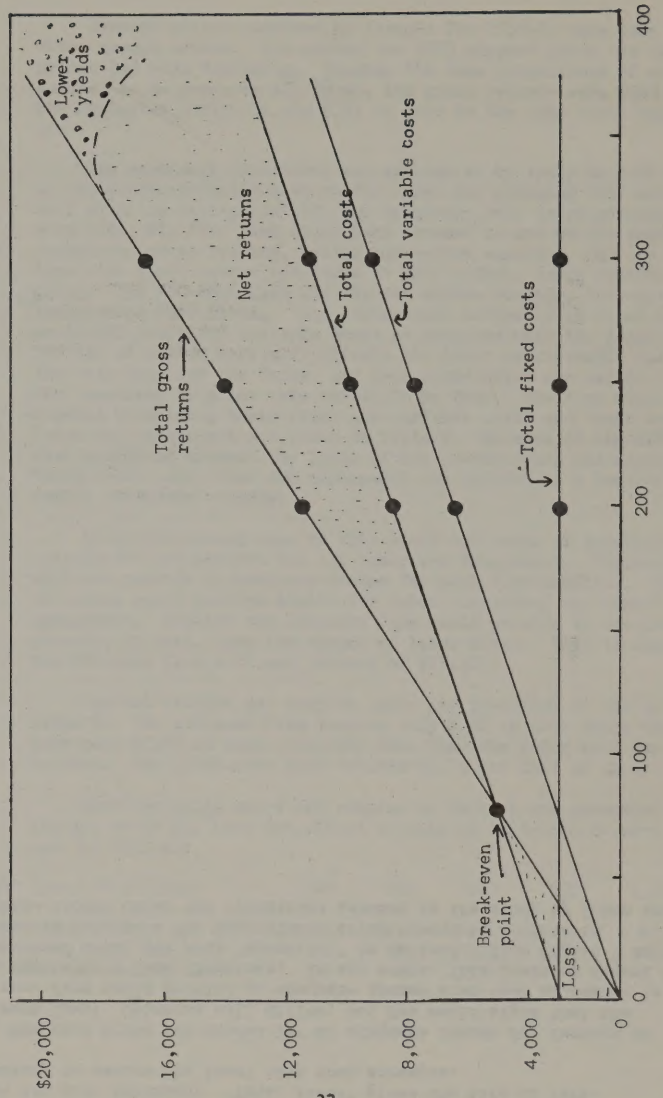


Figure 7.--Costs and returns from various sizes of farms using two 2-plow tractors and complements of other machinery, southern Iowa, 1963

Pasture returns are not included in Table 7 or Figure 7 even though pasture is an important resource. The upland farm has 74 percent of its land in crops and most of the rest is in pasture. True net returns for the farm should include whatever net income is derived from this pasture. Ihnen and Heady assumed that a beef cow-calf herd was kept, that each cow required 3.3 acres of pasture, and that the calf was sold at weaning. Gross returns per cow were given at $82. Cash costs of $35 were listed, but unfortunately, neither pasture rent nor feed costs were given. However, the following are estimates:

Gross returns per cow		$82
Pasture, 3.3 acres @ $4.70	$16	
Hay, 1 1/2 tons @ $14.00	21	
All other costs	35	
Total costs		72
Net returns to labor and management per cow		$10
Net returns per acre pasture		3

Before these net returns are added to the net returns from cropland, other alternatives should be considered. Sheep might be a better alternative. Dairy cows might give much more income. Hog and poultry enterprises probably could be added to provide profitable use of labor after the crop season. Another possible use of labor not needed for crop production is off-farm employment. Some farmers find this combination the most satisfactory. They may prefer to rent the pasture to others and take a job in town during the winter months. Because of these uncertainties the returns from the livestock enterprise are not included in the foregoing analysis. However, these returns should be kept in mind in determining the acres needed for an adequate income.

While this review has been limited to upland farms, Ihnen and Heady also studied hilly and average farms. They note that these three farms "have different soil mixtures, rotations, yields, field operators, etc. Despite these differences, the results . . . are quite similar. Minimum long-run average total cost is achieved at the same acreage (320) on each farm" (p. 142). They found that either a 2-plow, 3-plow or a 3-plow, 3-plow machinery combination was necessary to reach this least cost acreage.

If constant costs are defined as any costs within 5 percent of least cost, then constant costs could be achieved at the following ranges in crop acres:

Kinds of farms	Crop acres	Other acres	Total acres
Hilly farms	210-456	66-144	276-600
Average farms	232-380	73-120	305-500
Upland farms	196-380	62-120	258-500

"Other acres" consists largely of pasture, but lots, lanes, roads and waste are also included. "Total acres" gives the size of farm necessary to secure the least cost crop acreages.

How many acres are needed for an adequate income for farmers in southern Iowa? Opinions will differ, but few would argue that the 160-acre farm would provide an adequate income even when allowance is made for returns from livestock. In any event, this question cannot be answered until the word "adequate," is defined. Then Figure 7 may be used to determine the approximate acres needed to achieve an adequate income under the conditions assumed in the study by Ihnen and Heady.

V. ECONOMICS OF SIZE OF IRRIGATED FARMS

How large must an irrigated farm be in order to provide a satisfactory income for the farmer and his family? To answer this question the farm situation must be analyzed in much the same way as was done with the taxi business. The farmer must select at least one or more tractors with complements of machinery and spread their high fixed costs over enough acres to reduce costs to a minimum and thereby gain maximum returns.

Since a number of studies have already been made, it is not necessary to make a new or original study of the economics of farm size under either dryland or irrigated conditions, but it will be helpful to review four of these studies of farm size under irrigated conditions.

Economics of Size for Irrigated Cotton

Farms in Central Arizona

What is the minimum size of an irrigated cotton farm needed to provide an adequate income? This question is important because of the controversy over the 160-acre limitation on federal irrigation projects.

Nelson, in his study of irrigated cotton farms in central Arizona in 1964, used farm surveys in both irrigation districts and pump irrigation areas to establish the size of farms to be studied, crop rotations, crop yields, machinery needed, cropping practices, and labor requirements.[9] This information, plus other data, was then used in farm budgets to determine the net returns after different water and land charges were paid.

A constant mix cropping pattern was used regardless of the size of the farm but the pattern used in pump areas had 15 percent more cotton and less alfalfa than that of the irrigated districts. The patterns and yields per acre were as follows:

Crops grown	Irrigated districts		Pump areas	
	Cropland (percent)	Yield	Cropland (percent)	Yield
Cotton	40	2.3 bales	55	2.3 bales
Alfalfa	22	6.5 tons	9	4.25 tons
Barley	25	55 bushels	25	55 bushels
Sorghum	13	57-68 bushels	11	57-68 bushels

[9] Aaron G. Nelson, Costs and Returns for Major Field Crops in Central Arizona by Size of Farm, Arizona Agricultural Experiment Station Technical Bulletin 174 (1964).

Average prices received by farmers for 1958-62 were used for all crops except cotton. For cotton the 1963 support price was used because prices had been declining. Because the same proportions of crops were assumed to be grown on all farms, the gross returns were $230 an acre in the irrigated districts and $261 an acre in the pump areas regardless of size.

The machinery investment was arrived at by applying 1964 new prices to the machinery being used on the farms and reducing this amount by half with the assumption that the machinery was, as an average, half-worn out. All five farm sizes were assumed to use custom operators for combining, grain hauling, baling and cotton spraying, but the 140-acre farm also hired custom operators to pick cotton, scrap cotton, and landplane. The 280-acre farm did its own cotton picking, but scrapping and landplaning were hired. This custom work reduced high fixed machinery costs but increased variable costs as compared with the larger farms. The use of custom work also affects the labor requirements and costs. The rate used for the farmer and year-round hired men was $1.35 an hour. For temporary help the rate was $1.05 an hour. The five sizes of farms studied by Nelson, their fixed and variable costs and their returns to labor and management are shown in Table 8. Because of the difficulty of distinguishing between the labor of the operator and his family and hired labor, all labor and management are treated as a residual in this review of Nelson's study.

Under the assumptions of this study 140 acres of cropland produced only $1,246 net returns for all labor and management. Obviously, $1,246 will not provide an adequate income for most farm families. However, 280 acres would provide $6,484 for labor (including any hired) and management. Whether the 280-acre farm would provide an adequate income depends, in part, upon the amount of labor hired. This is also true of the 480-acre farm with net returns of $17,261.

The net returns per hour of labor are presented as the last line of Table 8. The 140-acre farm returns only $.58 an hour while the 280-acre farm pays $1.37 an hour--slightly more than the going rate for tractor drivers. The 1,600-acre farm returns $2.75 per hour of labor.

When the total costs and returns of Table 4 are presented as average costs per acre the effect of size on costs can be more easily seen as follows:

Acres of cropland	140	280	480	880	1,600
Gross returns per acre	$231	$231	$231	$231	$231
Total cost per acre	221	207	194	191	186
Net returns per acre	10	24	37	40	45

Table 8.--Net returns to all labor and management on cotton farms, irrigation districts, Arizona, 1964

Acres of cropland	140	280	480	880	1600
Total machinery (new cost)	$18,000	$31,000	$ 46,000	$ 73,000	$109,000
Land value per acre	1,000	1,000	1,000	1,000	1,000
Water charge per acre foot	4.50	4.50	4.50	4.50	4.50
Irrigation district charge	0	0	0	0	0
Gross returns @ $231 an acre	32,169	64,338	110,268	202,130	367,446
Total fixed costs	4,922	9,836	13,501	22,087	33,697
Total variable costs[a]	26,001	48,018	79,506	146,055	264,714
Total costs[a]	30,923	57,854	93,007	168,142	298,411
Net returns[b]	1,246	6,484	17,261	33,998	69,035
Total labor used (hours)	(2,165)	(4,720)	(7,933)	(13,870)	(25,121)
Return per hour of labor	$ 0.58	$ 1.37	$ 2.17	$ 2.45	$ 2.75

Source: Nelson, Costs and Returns for Major Field Crops in Central Arizona.

[a]Excludes all labor (including hired) and management.

[b]Net returns to labor (including hired) and management.

This picture may be misleading, however, since Nelson used the same yields regardless of size of farm, and in our analysis the extra costs of labor and management must be paid out of net returns per acre. Because the costs of management do increase sharply as size increases, one should not conclude that the largest farm will provide the highest net income.

The effect of land costs on the net returns, and consequently on the number of acres needed for an adequate income, is important. This is particularly true since the development of irrigated land now often approaches or exceeds $1,000 an acre. The land charge at 5 percent for the three small farms varies with land prices as follows:

Acres of cropland	140	280	480
Land at $500 per acre	$ 3,500	$ 7,000	$12,000
Land at $1,000 per acre	7,000	14,000	24,000
Land at $1,500 per acre	10,500	21,000	36,000

If irrigated land could be developed for $500 an acre rather than $1,000 (as assumed in Table 8), the 140-acre farmer would have another $3,500 of net income, the 280-acre farmer $7,000 more net income, and the 480-acre farmer $12,000 more net income. But, if the land cost is $1,500 an acre, the reverse would be true. These amounts mentioned would be subtracted from already low net farm incomes.

This analysis raises a question as to how much land suitable for irrigation in the Western States can be developed for irrigation at less than $1,000 an acre. There are reasons to believe that the amount is quite small. Successful farming, therefore, would require heavy subsidies for land development. Such subsidies are made by the Bureau of Reclamation from electric power revenues. The Bureau has estimated that developing land for irrigation in the recently approved Oahe project, for example, will cost $988 an acre. Users of Missouri River Basin power will pay 80 percent and farmers only 20 percent of that amount.[10] The Bureau states that "alfalfa, irrigated pasture and corn are expected to be the major crops grown on the basis of acreage, value, importance in rotation, and contribution to a livestock economy."[11]

In Nelson's study no irrigation charge was assumed (Table 8). However, Nelson did consider the effects of alternative irrigation district charges of $4 and $8 an acre. Such increased charges would reduce net incomes of the three small farms by the following amounts:

[10]U.S. Department of the Interior, Bureau of Reclamation, Region 6, Report of the Oahe Unit, James Division--South Dakota Missouri River Basin Project (Huron, South Dakota: Missouri-Oahe Project Office, 1965), pp. 2, 7, 121.

[11]Ibid., p. 107.

Cropland acres	140	280	480
Charge of $4	$ 560	$1,120	$1,920
Charge of $8	1,120	2,240	3,840

It is clear, then, that when such costs are encountered, the size of the farm would have to be enlarged to produce an adequate income however "adequate" may be defined.

Nelson also studied production possibilities under pump irrigation conditions in Arizona. As previously noted, 15 percent more cotton was assumed to be grown in the pump areas than in irrigation districts, and this increase raised gross income from $230 to $261 an acre.

Fixed costs of machinery and buildings remained the same as before, but depreciation and interest on pump and well were charged at $7 an acre thus increasing total fixed costs as shown in Table 9.

Total variable costs also increased because of the increased acreage of cotton. However, since these increases in costs were not enough to absorb all of the $31 increase in gross returns, net returns to labor (including hired) and management improved. Despite the fact that more labor was used, the returns per hour of labor also improved. This can be seen by comparing the last lines of Tables 8 and 9.

The water pumping charge used in Table 8 was $4.50 an acre foot. However, Nelson also determined the effect of higher rates of $8.50 and $11.00 on net returns. If other costs on returns remained the same, the additional or extra cost would reduce net returns on the three small farms shown in Table 9 by the following amounts:

Additional cost	140 Acres	280 Acres	480 Acres
$8.50 ($4.00 more)	$560	$1,120	$1,920
$11.00 ($6.50 more)	910	1,820	2,420

When water pumping charges are at these levels the 140-acre farm appears to be inadequate in size both on net returns and on returns per hour of labor.

Nelson also examined the effects of higher pump and well costs on net returns. Rates considered were $7, $11, and $14 an acre. Since the $7 rate was used in Table 9, the higher rates would result in additional costs that would have to be subtracted from net returns. The amounts for the three smallest farms would be as follows:

Additional cost	140 Acres	280 Acres	480 Acres
$11.00 ($4 more)	$560	$1,120	$1,920
$14.00 ($7 more)	980	1,960	3,360

Table 9.--Net returns to all labor and management on cotton farms, pump areas, Arizona, 1964

Acres of cropland	140	280	480	880	1600
Total machinery (new cost)	$18,000	$31,000	$ 46,000	$ 73,000	$109,000
Land value per acre	1,000	1,000	1,000	1,000	1,000
Water charge per acre foot	4.50	4.50	4.50	4.50	4.50
Pump and well cost per acre	7.00	7.00	7.00	7.00	7.00
Gross returns	36,540	73,080	125,541	229,680	417,600
Machinery costs[a]	4,922	9,836	13,501	22,087	33,697
Pump and well costs	980	1,960	3,360	6,160	11,200
Total fixed costs	5,902	11,796	16,861	28,247	44,897
Total variable costs[b]	27,724	50,089	82,112	150,350	273,470
Total costs	33,626	61,885	98,973	178,597	318,367
Net returns[c]	2,914	11,195	26,568	51,083	99,233
Total labor used (hours)	(2,619)	(6,022)	(10,427)	(18,385)	(31,122)
Return per hour of labor	$ 1.14	$ 1.88	$ 2.54	$ 2.80	$ 3.10

Source: See Table 8.

[a]Includes buildings and cement lined ditches, etc.

[b]Excludes all labor (including hired) and management.

[c]Net returns to labor (including hired) and management.

Again these higher rates make 140 acres of cropland appear quite inadequate both in terms of net returns and returns per hour of labor.

It is assumed that the cost of developing land for pump irrigation is $1,000 an acre--the same as for gravity irrigation discussed previously. If the land could be developed at less than $1,000, the land charges would be lower and the net returns higher. But if the land cost were more than $1,000, the reverse would be true.

There are, of course, many other possibilities and combinations that might be explored. Suffice it to say that any increase in costs--for land, water pumping, pump and well depreciation--that is not offset by increased gross returns increases the number of crop acres needed to provide an adequate income for a farm family.

The possibilities of increasing net returns from crops with net returns from livestock should not be overlooked. Beef cow-calf and ewe-lamb enterprises are the most important in the Western States, but they require many cows or ewes and much dryland for grazing if they are to be efficient enough to make an important contribution to the level of living of the farm family. The smaller the irrigated acreage the larger the livestock enterprises need to be to provide an adequate family income. Some estimates of costs and returns from livestock enterprises are presented in Table 11.

Dairy production is a possibility when a market exists for the product. Dairy cows provide a market not only for feed and hays produced but also for unused family labor. Livestock fattening enterprises, and hogs and poultry also provide an alternative to selling grain, and they utilize beet tops, straw and labor that otherwise might not be marketable.

Before leaving Nelson's analysis of farm size it is of interest to inquire whether a farmer with $4,922 fixed machinery costs would not be able to farm more than 140 acres of cropland and thus increase his net returns. Usually this would be possible but to remove any doubt, the fixed costs can be increased to $6,000 and then held constant while acres are varied as follows:

Acres of cropland	100	150	200
Total returns ($231/acre)	$23,100	$34,650	$46,200
Total fixed costs	6,000	6,000	6,000
Total variable costs ($171/acre)	17,100	25,650	34,200
Total costs	23,100	31,650	40,200
Net returns	0	3,000	6,000

Simple arithmetic will show the net returns for other sizes of farms, or a break-even chart like Figure 7, can be prepared.

Economics of Size of Beet and Potato Farms in Wyoming

Beets and potatoes are high value crops often grown on irrigated farms in the Western States. How small can these beet and potato farms be and yet provide the farm family with an adequate living? No studies of this question appear to have been made. However, Stevens has presented some costs and returns for irrigated crop enterprises secured from 49 irrigation farmers in the Big Horn Basin of north central Wyoming and from 57 farmers in the southeast Wyoming.[12] These data will be used to estimate the income possibilities of various sizes of beet and potato farms in Wyoming.

The 49 Big Horn Basin farmers had an average of 380 acres of irrigated cropland valued at $300 an acre. Of this land 305 acres were in the crops listed below. The average yields and average unit prices for 1961-65 were:

Crop	Acres	Yields	Price
Sugar beets	87	15.3 tons	$15.00
Corn-grain	13	80 bushels	1.15
Corn-silage	12	16 tons	6.67
Alfalfa hay	72	3.9 tons	20.00
Barley	43	75 bushels	1.20
Oats	28	70 bushels	0.70
Dry beans	50	18.5 cwt.	6.60

Per acre credits for by-products were as follows: sugar beet tops $16; corn fodder, oats, and barley straw $5; bean straw $3; hay $2.

Stevens' enterprise costs are summarized in Table 10. By applying these prices and costs to the acreages given above, the 305 acre farm was found to have an average gross return of $141 an acre and an average variable cost of $84 an acre. Total fixed costs for machinery on this average farm was $4,440, and total net returns to labor and management, including all hired labor, were $12,850. When the hired labor is paid, the net returns to the farm family would undoubtedly be sharply reduced, but the amount of labor involved could not be determined.

What would be the net returns on smaller farms using the same cost and return figures? The figures for a 300-acre farm as well as for three smaller sizes are as follows:

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[12] Delwin M. Stevens, Costs and Returns for Irrigated Crops in Wyoming, Wyoming Agricultural Experiment Station Bulletin 467 (1967).

Table 10.--Characteristics of irrigated farms and costs and returns by crops, Big Horn Basin, Wyoming, 1966

	Beets	Alfalfa	Corn	Dry Beans	Barley	Oats	Potatoes[f]
No. farmers growing	35	47	10	27	37	26	16
Average acres grown	87	72	13	50	43	28	109
Yield unit	ton	ton	bushel	cwt.	cwt.	cwt.	cwt.
Yield per acre	16	4.4	84	18.6	37	30	150
Price per unit	$ 15	$ 20	$ 1.15	$ 6.60	$ 2.00	$ 2.10	$ 1.90
Gross return per acre[a]	256	90	102	126	79	68	285
Total costs per acre[b]	203	83	94	102	70	68	222
Net profits per acre[c]	53	7	8	24	9	0	63
Fixed costs per acre[d]	23	11	13	13	9	9	20
Labor (hours per acre)[e]	(21)	(10)	(11)	(13)	(7)	(7)	(25)

Source: Stevens, Costs and Returns for Irrigated Crops in Wyoming, pp. 16-35.

[a]Gross returns include credit for by-products. [b]Including all labor at $1.50 an hour.

[c]Returns over all costs including labor. [d]Machinery only. [e]Includes operator's labor.

[f]Potato data for 16 producers in southeastern Wyoming.

Acres of cropland	100	150	200	300
Total returns	$14,100	$21,150	$28,200	$42,300
Total fixed costs	4,440	4,440	4,440	4,440
Total variable costs	8,400	12,600	16,800	25,200
Total costs	12,840	17,040	21,240	29,640
Net returns	1,260	4,110	6,960	12,660

While the total returns shown here include hired labor, if any, the amount of hired labor would probably be small. Hence, these returns approach what would be available for farm family living.

Stevens did not list the machinery used by the Big Horn farmers. However, it is probable that those farms with only 100-200 acres of cropland had less machinery than did the average 305-acre farm, and it may be that these fixed costs should be reduced somewhat. However, a reduction in fixed machinery costs may be offset by more variable costs for custom work and possibly more hired labor. Therefore, it cannot be assumed that the net returns would increase by the same amount that fixed costs are reduced.

Livestock is another factor affecting the net returns of the Big Horn Basin farmers. Stevens notes that these farmers fed an average of 216 head of beef calves or equivalent in lambs. In addition, the average farm had 34 beef cows and a flock of 86 ewes to utilize the 33 acres of irrigated pasture and an unspecified amount of dryland pasture. The silage, hay and by-products were credited to crop production, but they would need to be charged to the livestock at the same rate in estimating any additional net returns from this source. Perhaps the most that can be expected from the livestock enterprises is that the values set on the by-products be achieved. Professor Roscoe Snapp, formerly beef production specialist, University of Illinois, used to tell his students that a beef cow should be regarded as a machine to convert unmarketable roughages into a salable product. This view is supported by most studies not only of beef cattle but of sheep. Estimates based on such studies prepared by Aanderud and Crandall indicate the low net returns that can be expected from various beef and sheep enterprises.[13] Under current prices and costs, net returns were only $2.50-4.50 per cow-calf unit and $1.00-$3.00 per ewe. Feeder cattle averaged $3.50 to $17.00 a head. Feeder lambs returned only $49 per 100 head (Table 11).

Stevens also presented potato enterprise cost data on a survey of 16 potato farms in southeastern Wyoming. He noted that these farms averaged 109 acres of potatoes, but he did not indicate the other crops grown. Nevertheless, the income possibilities of potatoes can be evaluated by substituting 87 acres of potatoes for the 87 acres of sugar beets on the

[13]Wallace G. Aanderud and Francis Crandall, Planning for More Profitable Use of Resources, South Dakota Agricultural Extension Pamphlet EC-652 (1966).

Table 11.--Estimated costs and returns for various livestock enterprises, South Dakota, 1966

	Beef cow--calf[a]	Beef cow--feeders sold[b]	Beef cow--feeder calf sold[c]	Yearling heifers[d]
Gross returns	$95.42	$106.16	$100.27	$211.61
Pasture costs	30.45	30.60	36.99	------
Other feeds	24.34	31.83	21.62	65.00
Cash costs	21.58	21.92	22.63	132.02
Interest	15.17	15.64	15.52	7.42
Depreciation	1.48	1.68	1.61	3.60
Total costs	93.02	91.67	98.37	208.04
Net returns	2.40	4.49	1.90	3.57
Labor (hours)	(8)	(9)	(10)	(4.5)

Source: South Dakota Agricultural Extension Service Pamphlet EC652 (1966).

[a]Assumes feeder calves sold, 88% calf crop, 16% replacement rate calving of 2-year olds.

[b]Assumes calves sold as feeders, 88% calf crop, 16% replacement rate calving of 2-year olds.

[c]Assumes calves sold as feeders, 90% calf crop, 16% replacement rate calving as 3-year olds.

[d]Assumes liberal grain and gain of 425 pounds in 7.5 months on feed.

Table 11.--(Cont.) Estimated costs and returns for various livestock enterprises, South Dakota, 1966

	Feeder steer calf[e]	Feeding heavy steer calf[f]	Ewe and lamb[g]	Ewe and lamb[h]	100 Feeder lambs[i]
Gross returns	$241.08	$275.29	$22.58	$25.53	$2,074.17
Pasture costs	-----	-----	6.00	6.00	-------
Other feeds	81.60	65.25	4.15	4.85	432.00
Cash costs	129.37	193.90	9.47	9.53	1,470.39
Interest	9.64	8.14	1.59	1.60	58.44
Depreciation	3.60	3.60	.52	.52	64.00
Total costs	224.21	270.89	21.73	22.50	2,024.83
Net returns	16.87	4.40	.85	3.03	49.34
Labor (hours)	(6.6)	(4.0)	(2.0)	(2.5)	(30.0)

Source: See first page of table.

[e]Assumes liberal roughage and gains of 600 pounds in 11 months on feed.

[f]Assumes liberal roughage and gains of 400 pounds in 6 months on feed.

[g]Assumes 110% lamb crop, lambs sold as feeders, 20% replacement ewes purchased, 2% ewe death loss.

[h]Assumes 110% lamb crop, half of lambs sold as feeders and all others fed and sold fat; 20% replacement ewes purchased; 2% ewe death loss.

[i]Assumes drylot, 3 month feeding period and gain of 30 pounds per lamb.

305-acre farm examined earlier. With potato yields of 170 cwt. per acre priced at $1.90 per cwt., the net returns for these 87 acres would increase from $7,435 for beets to $12,069 for potatoes.

Why is it then that sugar beet producers do not switch to potatoes? One reason is that the price of potatoes is very sensitive to supply and is therefore erratic (Figure 8). When potatoes are in short supply relative to demand, the price is good and many farmers are induced to plant. But when the supply of potatoes is large, the price falls simply because the demand for potatoes is highly inelastic; that is, a low price for potatoes does not induce people to eat a lot more of them. The production of sugar beets is subsidized with the acreage controlled, and while the income may be less, price risks are also less. However, new land just brought into production may not be able to acquire a sugar beet allotment. In contrast, entry into potato production is not restricted by the government, but risks are high.

What then, can be said about the minimum amount of irrigated cropland needed for an adequate level of living in Wyoming? By almost any definition of adequacy it would appear that 100 acres of irrigated crops including a large acreage of subsidized sugar beets are not enough. At least 150 acres would appear to be needed even with some income from livestock. The precise amount would depend upon the definition of an adequate level of living.

Irrigated Potato Farms in Idaho

Irrigation of land is an expensive process. To be profitable, high value crops must be produced at low cost. One such crop, popular in Idaho, is potatoes. Potato acreage has tripled since 1920, doubled since 1940, and now constitutes 13 percent of all farms receipts in Idaho.

The most remarkable change in potato production has been the substitution of machinery for labor. Seasonal labor, a variable cost, has been largely converted into machinery, a high fixed cost. What happens to this high fixed cost when it is spread over more acres? Using the results of a survey of 88 irrigated potato farms as a basis, Withers has sought to answer this question for potato production on the upper Snake River Valley and in south central Idaho.[14]

These two potato producing areas are similar, but farms on the upper Snake were smaller and were estimated to produce 200 cwt. of potatoes as compared to 211 cwt. for the south central area. Land in both areas was valued at $250 an acre. Potatoes, sugar beets, small grain and alfalfa are the most important crops in both areas. In the southeastern area cost data were secured from 20 potato farms that ranged from 600 to 838 acres

[14] Russell V. Withers, Potato Production Costs, Idaho Agricultural Experiment Station Bulletin 447 (1965).

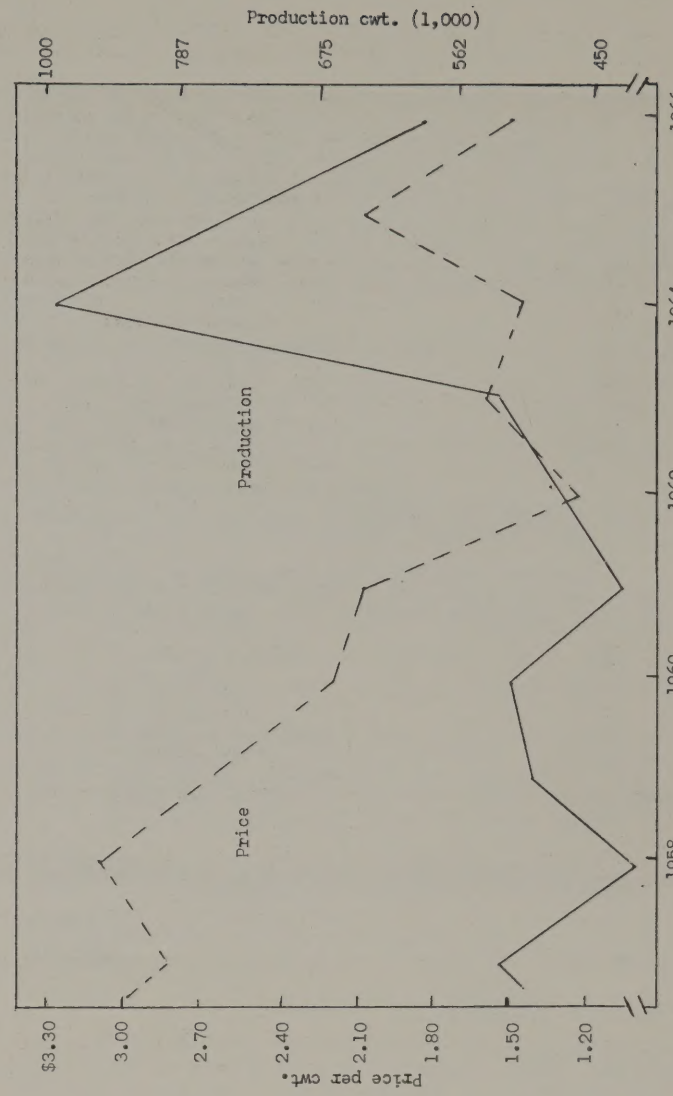

Figure 8.--Relation of potato prices to potato production, ten years, Wyoming, 1957-1966

Source: U.S. Department of Agriculture Crop Production, Agriculture Marketing Service, Crop Reporting Board Annual Summary Reports, (1957-1966). U.S. Department of Commerce, Bureau of the Census, Statistical Abstract(s) of the U.S. 1959-1967.

each. These data were used to calculate the costs for potato enterprises ranging from 140 to 300 acres. While only about one-third of the cropland was in potatoes, only the costs of potato production were analyzed.

Withers made no attempt to estimate the gross returns from the potato crop. No doubt the main reason was that potato prices are highly erratic. He did present Idaho potato production and prices graphically for the years 1950-1963 as reproduced in Figure 9. In only five of these 13 years were potato prices higher than $1.50 per cwt. Since they ranged from $1.00 to $1.50 per cwt. during the remaining eight years, it seemed reasonable to use $1.25 for this analysis of returns to labor and management. At this price the total gross returns in southeastern Idaho would be $264 an acre.

Withers found that the variable cost per acre was $154. This included seed costs of $50 an acre, fertilizer costs of $30 an acre, and the hired labor and operator's labor cost of $32 an acre.[15] It appears that $14 of the $32 are hired labor charges. Because the object of this review is to determine the residual for all labor and management, whether hired or not, the hired labor costs have been subtracted leaving an average variable cost of $140 an acre.

Total fixed costs of potato production consist of "costs...not related directly to output such as machine depreciation, insurance, property taxes interest on investment and operator labor."[16] In order to determine the net returns to labor and management, the operator's labor needs to be subtracted from total fixed costs. Unfortunately, this is not easily done because the amount of operator's labor is not clearly stated. An alternate solution is to estimate machinery fixed costs. This is easier since Withers states that "potato machinery investment was essentially the same on all these farms." He also notes that the minimum amount of equipment necessary to maintain a reasonable potato enterprise was about $38,700. Depreciation on this machinery at 10 percent would be $3,870 a year. Interest at 6 percent on inventory value (one-half new cost) is another $1,161, making a total of $5,031. To this amount should be added taxes, insurance and housing costs. Thus, total fixed costs would be approximately $5,200.

Using the price-cost data just presented, the net returns to labor and management for three given acreages of potatoes are as follows:

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[15] Ibid., pp. 14, 18.

[16] Ibid., p. 10 (underlining added).

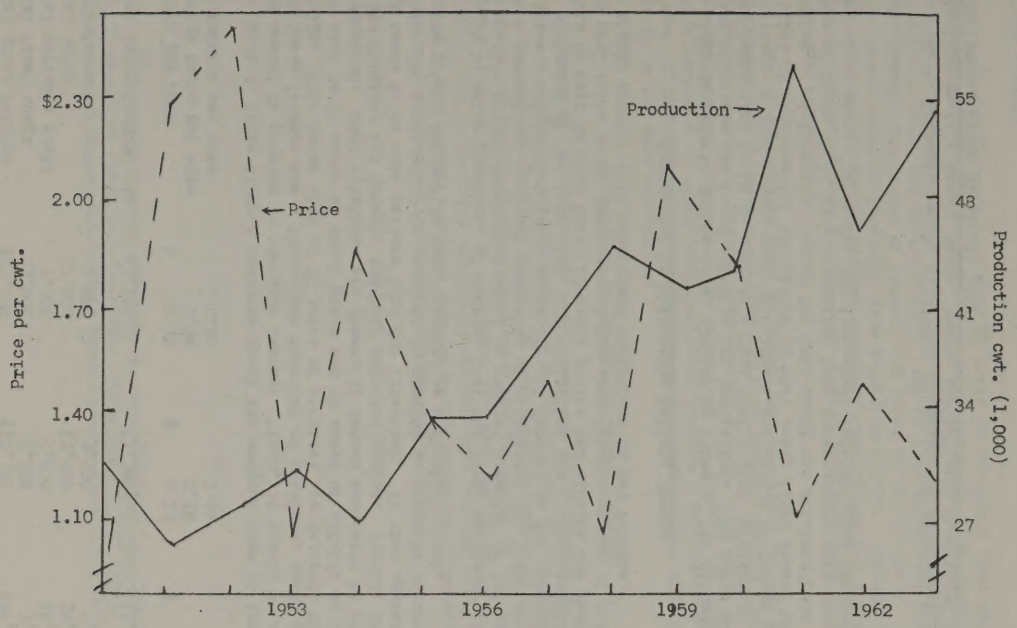

Figure 9.--Relation of potato prices to potato production, Idaho, 1950-1962

Source: Withers, Potato Production Costs, p. 19.

Acres of potatoes	50	70	100
Total gross returns	$13,200	$18,500	$26,400
Total fixed costs	5,200	5,200	5,200
Total variable costs	7,000	9,800	14,000
Total costs	12,200	15,000	19,200
Net returns	1,000	3,500	7,200
Total labor (hours)	(1,100)	(1,540)	(2,200)
Return per hour	$ 0.90	$ 2.25	$ 3.24
Average costs per acre	2.44	2.14	1.92
Net returns per acre	0.20	0.50	0.72

What do these figures indicate about the minimum size of irrigated farm needed to provide an adequate income? First, it should be recalled that these farmers use a three-year rotation of potatoes, small grain and alfalfa. This means that if 70 acres of potatoes are desired, then there must also be 70 acres of small grain and 70 acres of alfalfa or 210 acres of cropland. Such rotations are generally deemed necessary to control potato diseases and insects and help maintain yields. Second, there probably needs to be some pasture land for livestock. It then appears that perhaps 240 acres would be required to provide an adequate income if a 70-acre potato enterprise were selected as a starting point.

It is quite possible, of course, that the fixed machinery costs on the smaller potato enterprise could be reduced somewhat by the use of custom harvesting, or joint ownership of machinery; yet there are limits to these possibilities since generally all farmers in the community need the equipment at the same time. In evaluating the acreage needed it should be kept in mind that (1) small grains and alfalfa are generally less profitable crops than are potatoes and (2) the prices of potatoes are highly erratic with consequent variations in net returns.

Irrigation in Willamette Valley, Oregon

Suppose federal public lands similar to those of the Willamette Valley of Oregon are found suitable for irrigation. How large would these farms need to be to provide a farm family with an adequate level of living? A 1955 study, made by Caldwell and Castle of income possibilities of supplemental irrigation in that area, helps answer this question.[17] Information needed for this study was obtained from a survey of farms which were classified into three groups with average sizes of 40 acres, 103 acres (60 irrigated) and 280 acres (80 irrigated).

[17] H. W. Caldwell and E. N. Castle, Economics of Supplemental Irrigation on Polk County Farms, Oregon Agricultural Experiment Station Miscellaneous Paper 39 (April 1957).

Many of the farmers with 40 acres or less had off-farm employment. If these farmers were to devote full time to farming, the enterprises and combination selected would need to provide incomes comparable to their off-farm opportunities. One such combination considered was as follows:

Crop	Acres	Tons/acre	Price/ton
Strawberries	4	9	$320
Pole beans	16	128	125
Canning corn	15	62	20

The returns to the operator for his labor and management were calculated as follows:

Total gross returns	$20,110
Hired labor costs	1,500
Machinery and building depreciation costs	440
Interest on investment	1,018
Water costs	986
All other costs	12,904
Total costs	16,848
Returns to operator	3,262

Whether a person could afford to give up an off-farm income for such returns depends upon the amount of that income as well as upon personal preferences. No doubt, many would find $3,300 inadequate.

When 60 acres of irrigated land were devoted largely to producing feeds for various livestock enterprises, the operator's returns for his labor and management were as follows:

Dairy, 40 cows	$3,504
Dairy, 60 cows	5,818
Beef, 60 cows	-2,794
Beef, 75 cows	-3,730
Beef, 92 feeders	4,241
Alfalfa hay production	1,969
Dryland crops	-375

Feeding 92 head of beef calves would require an additional capital investment and would give the operator $4,200 if 1954 prices were paid and received for the calves. Because the difference or margin between prices paid and received is so important and variable, it is doubtful whether this enterprise would produce the stability of income needed--even if it were judged to be adequate. A 60-cow dairy herd would produce a fairly attractive income of $5,800. This herd would require one full-time hired man and another hired man for six months during the summer. If family members were available for part of this labor, thus reducing costs, net returns would increase accordingly. One full-time man was

assumed to be hired with the 40-cow herd. The beef cow enterprises, and dryland crop production all failed to produce any income under the conditions assumed.

A larger 280-acre farm with 80 acres of irrigated land would give the farmer higher returns for his labor and management. For example, the 60-cow dairy herd that produced $5,800 net returns on a 103-acre farm (60 irrigated) would now return $6,900. And by increasing both the size of the farm and the number of feeders fed (from 92 to 150 head), returns to the farmer could be increased from $4,200 to $7,200. Dryland farming of the 280 acres without livestock produced a net return for operator's labor and management of only $2,900--thus showing the importance of both irrigation and livestock.

The study reviewed here indicates that 280 acres of land (with 80 acres irrigated) would provide considerably more income than the smaller 103-acre farms but would also require considerably larger investment in irrigation development and livestock. The study does not support the idea that a 160-acre farm with 60 acres irrigated would provide a satisfactory or adequate level of living for a farm family, except possibly where milk production is to be the main enterprise.

Irrigation on Deschutes Project, Oregon

The need for irrigation farms large enough to provide an adequate level of living is well illustrated by the history of the North Unit of the Deschutes Irrigation project of west central Oregon as presented by Kimball and Castle.[18] The first water was delivered to the 50,000-acre North Unit in 1946, and by 1949 water had been delivered to all the project lands. The project was originally divided into 642 operating units, but by 1957 this number had been reduced to 407 units, or 37 percent less. The changes in number of farms by size were as follows:

Size class (acres)	1946	1957	Change (percent)
Under 40	148	68	-54
40 to 80	225	95	-58
80 to 160	247	156	-37
Over 160	22	88	+30
Totals	642	407	-37

[18] Norman D. Kimball and Emery N. Castle, Historical Development and Adjustments on North Unit Deschutes Irrigation Project Farms, Oregon Agricultural Experiment Station Miscellaneous Paper 133 (1962).

In 1946 the average size of the farms was 77 acres, but by 1958 the average size had increased by 60 percent to 122 acres.

The distribution of the 50,000 acres among the different sizes of farms also changed drastically during the same period as shown in the following figures:

Size class (acres)	1946 (acres)	1957 (acres)	Change (percent)
Under 40	3,700	1,600	-57
40 to 80	13,800	6,200	-55
80 to 160	26,500	18,500	-30
Over 160	4,500	22,200	+39

Why the instability in farm size? To answer this and other questions, a survey of 56 farms in this irrigation project was made. The survey revealed that the average crop income was nearly $20,000 and that more than half of this income was from potatoes. Potatoes were usually followed by two years of small grain and three years of alfalfa. One-fourth of the income was from grain, mostly wheat. Some farms produced alfalfa seed and a few, Merion bluegrass seed.

Median net income was about $6,000, but there were wide variations. Two farms with the lowest incomes each lost $3,500, while the two highest each made over $50,000. The average farm had 152 acres, and its average net income was $8,400. The average net farm incomes by size of farm classes were as follows:

Size class (acres)	Average net income
30 to 90	$ 1,198
90 to 160	6,059
Over 160	19,461

As is generally the case, a few of the largest farms made less net income than smaller farms. This indicates that the effect of size has been offset by other factors that tend to reduce farm income. Poor management, less valuable crops, local weather such as hail, and small numbers of livestock are often causes of these inconsistencies.

By the use of farm budgets the authors were able to control management, crop rotations, yields, prices and costs while the size of the farm was allowed to increase. Thus, the effect of increasing size alone could be demonstrated. The crop rotation plan contained 16 percent potatoes, 33 percent small grain and 50 percent alfalfa. Yields and prices were held constant as follows:

Crop	Yields	Prices
Potatoes	360 cwt.	$ 1.20
Wheat	56 bushels	2.07
Barley	70 bushels	0.98
Alfalfa	42 tons	15.50

Some other characteristics of the three farm sizes and the operator's net returns for his labor and management were as follows:

Cropland acres	60	140	240
Value of land per acre	$ 250	$ 250	$ 250
Machinery cost per acre	166	84	100
Total gross returns	8,355	18,423	31,280
Total fixed costs	1,463	2,578	5,071
Total variable costs	5,963	12,480	19,658
Total costs	7,426	15,058	24,729
Net returns	929	3,365	6,551
Average cost per acre	124	108	103
Net returns per acre	15	24	27

The increase in machinery costs between the 140-acre farm and the 240-acre farm was due, in part, to a shift from custom hire to ownership of machinery. The increases in net returns once again demonstrate the importance of farm size.

Livestock are not included in these budgets. In appraising the results, it should be noted that 60 percent of the 56 farmers surveyed owned livestock. Feeder cattle were reported on 41 percent of the farms, dairy cows on 18 percent, ewes on 9 percent and beef cows on 5 percent. Gross income from livestock averaged nearly $9,000 per farm. If efficiently managed, the livestock would increase the net returns to the operator for his labor and management.

It should also be mentioned that the 240-acre farm includes $3,000 for hired labor. If members of the family could perform part of this labor, income for family living would be increased accordingly.

Irrigated Farms in Imperial Valley, California

In the event that federal public lands similar to those of the Imperial Valley in California are found to be suitable for irrigation, what would be the minimum size of farm that would provide an adequate level of living for a farm family?

Dean and Carter interviewed 86 growers in the Imperial Valley and used the information to study the effect of farm size on costs and

returns.[19] The Imperial Valley borders on Mexico in the southeastern part of California and is about 45 miles long and 30 miles wide. It contains about 900,000 acres with 500,000 acres presently irrigated. The climate is arid with low humidity, and the Valley receives less than three inches of rainfall per year. It is hot, with temperatures of 100° F. from March to November, and the winters are mild enough to permit farming all year. Lettuce, for example, is harvested from late December to April, and livestock can be pastured from November to March. Farms in the Imperial Valley have been growing larger at a rapid pace as can be seen in the following figures:

Size class (acres)	1940 (percent)	1959 (percent)
Under 100	66	46
100 to 180	15	12
180 to 260	5	7
260 to 500	8	13
500 to 1,000	3	12
1,000 or more	2	9

Note the 20 percent decline in farms under 100 acres in size and the sharp increase in the larger farms, especially those of 500 acres or more.

Inevitably as farms became larger, an increasing percentage of all land is found in the bigger farms as can be seen in these figures:

Size class (acres)	1940 (percent)	1959 (percent)
Under 100	16	4
100 to 180	14	5
180 to 260	8	4
260 to 500	17	13
500 to 1,000	14	23
1,000 or more	30	51

Note the decline in percentage of land held by farms under 500 acres and the sharp increase in percentage held by farms larger than 500 acres.

The 37 field crop farmers surveyed had the following crops and yields per acre:

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[19] Harold O. Carter and Gerald W. Dean, Cost-Size Relationships for Cash Crop Farms in Imperial Valley, California, California Agricultural Experiment Station Giannini Foundation Research Report 253 (1962).

Crops grown	Acres	Yields
Sugar beets	211	22 tons
Cotton	240	2.2 bales
Barley	273	1.8 tons
Flax	179	45 bushels
Alfalfa hay	478	6.0 tons

The typical farm had nearly 1,100 acres of land of which 1,000 was irrigable. About half the land was owned and half rented. The annual labor bill was $44,000 of which $34,000 was for hired labor and the rest for management--including the operator's.

Because of the nature of the crops and the high labor requirements and costs, machinery investment was heavy. The average was $40,000 but ranged from $1,000 to $350,000.

The average annual gross income of these 37 farms was nearly $200,000 but ranged from $20,000 to $1,500,000. Their productive cash expenses averaged $53,000 but ranged from $5,000 to $354,000.

Quite clearly, few of the 80 farms surveyed represented the minimum size necessary to produce an adequate level of living for a farm family. However, the data does present a point of departure for the search. In the study previously cited Carter and Dean also determined the least cost acreage for field crops in the Imperial Valley. They used the following crops, yields and prices to find total revenue per acre:

Crop	Acres (percent)	Yields	Prices
Alfalfa	40	6.0 tons	$ 26.00
Barley	20	1.75 tons	45.00
Flax	10	45 bushels	2.90
Sugar beets	15	22 tons	14.39
Cotton	15	2.2 bales	158.40
Cotton seed	15	1.0 tons	40.00

The total gross returns for these field crops was $202 an acre (Carter and Dean, Table 6). To handle 320-640 acres of these crops a $59,000 investment in machinery was deemed necessary. Carter and Dean indicate that the average fixed cost of machinery was $18 an acre when spread over 400 acres (their Fig. 4). Hence, total fixed costs would be $7,200 ($18 x 400).

Carter and Dean also show that total average costs are $170 an acre (their Fig. 5). Therefore, the average variable cost can be obtained by subtracting average fixed costs of $18 an acre. Because the farmer and his family may be able to provide all of the labor on the smaller farms, the $27 an acre labor charge may also be subtracted leaving an average variable cost of $125 an acre ($170-18-27=$125).

Using these gross returns and costs the operator's net returns for his labor and management (including bookkeeping and supervision) can be approximated as follows for these three sizes of farms:

Cropland acres	100	160	200
Total returns	$20,200	$32,320	$40,400
Total fixed costs	7,200	7,200	7,200
Total variable costs	12,500	20,000	25,000
Total costs	19,700	27,200	32,200
Average total costs	197	157	161
Net returns	500	5,120	8,200
Labor (hours)	(2,400)	(3,740)	(4,800)
Return per hour	0.21	1.37	1.71

As noted, the $7,200 of fixed costs are for machinery capable of handling up to 640 acres of crops. With a reduction of up to 200 acres of cropland less costly machines might reduce costs and increase net returns. Greater specialization or custom hire might eliminate some machinery and reduce costs. Carter and Dean use $1.60 an hour for skilled labor and $.80 an hour for unskilled. About half of the labor was unskilled. Hence, the average rate would be about $1.20 an hour. Any returns above this rate would be returns for management including supervision of labor, bookkeeping, risks, and uncertainty.

As part of this same study Carter and Dean also investigated a crop rotation with one-third less sugar beets and cotton and one-third more barley, a rotation that they stated might be "representative of young or new field crop farmers." This change in the crop rotation reduced gross returns from $202 to $174 an acre. While costs were also reduced, net returns fell about $3 an acre at the 400-acre size.

The authors also investigated the effects of a 50 percent increase in wages with unskilled wages being increased from $.80 to $1.20 and skilled from $1.60 to $2.40 an hour. They found (pp. 34-36) that these wage changes would increase total average costs about 10 percent regardless of the size of farm. However, if farms under 400 acres used mechanical cotton picking for their second crop, their costs would increase only 6-7 percent while those of 1,000 acres or more would still be 10 percent higher since they were already assumed to be using mechanical pickers. Additional technology such as replacing hand hoeing and thinning with weed sprays, flame cultivation, and mechanical blocking for both cotton and sugar beets made little or no difference in costs for farms of 1,000 acres or more. The effect of new technology on crop yields would vary with many factors and especially with the skill with which it was used. Small farmers might have considerable advantage in this respect over larger ones that had to depend on hired labor. Also as noted, costs would increase less for the smaller farmers. This cost advantage would be still greater

if there were a 100 percent increase in wages (Carter and Dean, Fig. 7). However, while any increase in wages would favor family farms, farms of 1,000 acres or more would still have the lowest costs per acre.

Cotton-General Crop Farms, San Joaquin Valley, California

Some evidence concerning the minimum size of a cotton-general crop farm in the San Joaquin Valley which would provide an adequate income can be gained from cost and return studies of a typical farm in the Valley by Goodsell and others.[20] Goodsell declares that "In all instances, the typical farms are important operating units in the specific area and in most instances they are the most common units." The cotton-general crop farm in the San Joaquin Valley on which he reports had the following characteristics in 1966:

Crops	Acres	Yield	Gross returns
Cotton	111	295 pounds	$34,000
Alfalfa	119	5.7 tons	19,300
Barley	38	54 bushels	2,500
Corn	46	77 bushels	5,400
Other, including government payments	---	---	11,500
Perquisites	---	---	700
Totals	314		$73,400

Thus, the gross returns per acre averaged $234 for this farm. Since these returns are typical for the area, it is reasonable to assume that they can be secured on farms of somewhat different sizes so long as size does not cause untimely operations that lower yields.

Goodsell reports that total costs for this 314-acre typical farm were $67,900 of which $47,823 were operating expenses and $20,093 were current interest on capital investment. When these expenses are subtracted from the total gross income of $73,400, there remains $5,400 for operator's labor and management. He also shows that if the historic interest rate of 4.1 percent is used for all capital, the returns for the operator's labor and management are $10,200; but since this review is concerned with the future rather than the past, current interest rates are used in this analysis. The total fixed cost of the $32,000 machinery investment is about $7,500. Of this amount $5,571 is depreciation, and $1,600 is

[20] Wylie D. Goodsell and others, Farm Costs and Returns, Commercial Farms by Type, Size and Location, U.S. Department of Agriculture, Agriculture Information Bulletin 230 (1967), pp. 56-57.

interest on investment at 5 percent.[21] The balance is taxes, insurance and housing costs. Since total costs are $67,900, subtraction of the $7,500 total fixed costs leaves total variable costs of $60,400 for this 314-acre farm. Thus the variable cost is $192 an acre.

These figures may now be used to explore the net returns that might be secured from farms of other sizes:

Cropland acres	200	300	400
Total gross returns	$46,800	$70,200	$93,600
Total fixed costs	7,500	7,500	7,500
Total variable costs	38,400	57,600	76,800
Total costs	45,500	64,500	83,500
Net returns	900	5,100	9,300
Operator's labor (hours)	(1,660)	(2,490)	(3,320)
Return per hour	0.54	2.05	2.80

It is assumed that the size changes indicated do not affect gross returns of $234 an acre, variable costs of $190 an acre, and total fixed costs of $7,500. However, although total fixed costs are constant, the average fixed costs fall as they are spread over more acres. As a result, average total costs fall and net returns increase as shown in these figures:

Cropland acres	200	300	400
Gross returns per acre	$234	$234	$234
Average total costs per acre	230	217	211
Net returns per acre	4	17	23

While there is no reason to believe that the differences in size would affect either gross returns or variable costs, it is possible that total fixed costs could be reduced on the 200-acre farm by using custom hire for certain operations. However, it seems quite unlikely that these costs could be reduced by more than $1,000, and this reduction is not enough to provide $3,000 net returns on this 200-acre farm. If $5,000 is deemed an adequate income for a farm family, a 300-acre farm is needed under the conditions that existed in 1966.

[21] Depreciation from Wylie D. Goodsell, Economic Research Service, U.S. Department of Agriculture (letter, 14 November 1968).

VI. ECONOMICS OF SIZE OF DRYLAND FARMS

What is the minimum size of dryland farm needed to provide the farm family in the Western States with an adequate income? Obviously, the size needed will be considerably larger than in southern Iowa where rainfall is plentiful and the growing season long. It will also be considerably larger than that of irrigated farms with their high yields of valuable crops.

There is much historical data to indicate that the dryland farms created by the 160-acre and 320-acre limitations on homesteads have been too small for the Western States. The evidence is found in repeated and persistent efforts to get these limitations changed, in the failure of farmers to get approval for entry, and in the high rate of failure to secure patents as revealed by data presented elsewhere in this report.

If the homestead laws created farms that are too small, how large should they be? The answer varies depending upon yields, costs and prices of the particular area. Fortunately, there have been studies made that discuss the economics of farm size. These will now be reviewed by means of the same techniques used for irrigated farms in the foregoing discussion.

Wheat-Fallow Farms in Montana

Wheat-fallow farms are characteristic of much of the wheat growing areas of Colorado, Montana and Wyoming. If additional wheat-fallow farms are to be created out of public lands, how large must they be to provide an adequate income for a farm family? Rude provides some information on this point in his study of three alternative wheat-fallow plans for four sizes of farms in northeastern Montana.[22] Data for the study was secured from a survey of 39 farms in this area.

Only the most profitable plan will be discussed. This plan places about one-fourth of the cropland in the Conservation Reserve. The crop plans, number of cows kept, and machinery investment are shown in the following figures:

[22] LeRoy C. Rude, Land Use Alternatives for Dryland Grain-Livestock Operators in Northeastern Montana, Montana Agricultural Experiment Station Bulletin 572 (1962).

Total acres in farm	1,370	1,760	2,830	5,080
Cropland total acres	470	846	1,306	2,520
Wheat acres	125	260	410	800
Fallow acres	125	260	410	800
Conservation reserve acres	126	236	332	672
Hay-alfalfa, etc.-acres	94	90	154	248
Cows, number	38	36	62	101
Machinery investment	$12,000	$15,000	$17,000	$23,000

Conservation payment rates used were $7.66 an acre for diverted acres and $3.83 for non-diverted acres (summer fallow). Spring wheat yields used were 13 bushels per planted acre. This was the 12-year average for the area for 1944-1955. The wheat price used was $1.72 per bushel. Cropland was valued at $50 an acre while pasture was valued at $10 an acre. A 5 percent interest rate was used on land and 6 percent on machinery and livestock.

For the best of three alternative wheat programs in 1960, Rude's budgets showed the following gross income, expenses and net returns to the operator for his labor and management:

Total acres in farm	1,370	1,760	2,830	5,080
Cropland total acres	470	846	1,306	2,520
Total gross returns	7,056	10,302	15,957	29,592
Cash expenses	2,419	3,346	4,341	7,414
Depreciation	1,918	2,321	2,528	3,649
Interest on investment	3,158	4,314	6,709	10,981
Total costs	7,495	9,981	13,578	22,044
Net returns	-439	321	2,379	7,548
Average total costs per acre	16	12	10	9
Net returns per acre	-1	0	2	3

Rude's analysis suggests that at least 4,000 acres or more may be needed to provide an adequate level of living under the conditions assumed in this study. The most profitable of the sizes studied was the 5,080-acre farm. The main reason is that the costs per acre are lowest for this farm (see last two lines of table).

Using another survey of 39 farmers as a source of information, Rude also made a study of the effect of size and alternative crop-livestock plans on net returns in north central Montana.[23] The size of farms and

[23] LeRoy C. Rude, Land Use Alternatives for Dryland Grain-Livestock Operators in North Central Montana, Montana Agricultural Experiment Station Bulletin 571 (1962).

the crop plans were the same as those for northeastern Montana and need not be repeated here. But since winter wheat is grown in this area, a winter wheat yield of 20.2 bushels per planted acre was used--the 12-year average from 1944-1955. Note that this is 7.2 bushels higher yield than used in northeastern Montana. However, the price of winter wheat was $1.61 a bushel--11 cents less than spring wheat. The payment for Conservation Reserve acres was $8.90 an acre and $4.45 for summer fallow. Cattle prices used were the same in both studies: $19 per cwt. for cows and $23 per cwt. for feeder calves. A few more cows were kept in the north central area than in the northeastern area. For these reasons gross income was higher, but costs were also higher.

Land values in the north central area were assumed to be 50 percent higher than in the northeastern area; listed values per acre were $75 for cropland and $15 for pasture. Machinery investment was also somewhat higher.

For the most profitable wheat-fallow plan, the total gross returns, costs, and net returns to the operator for his labor and management follow:

Total acres in farm	1,370	1,760	2,830	5,080
Cropland acres	470	846	1,306	2,520
Total gross returns	$ 8,878	$13,823	$21,395	$40,177
Cash expenses	2,500	3,391	4,673	8,231
Depreciation	1,932	2,351	2,753	4,121
Interest on investment	3,889	5,596	8,556	15,030
Total costs	8,321	11,338	15,982	27,382
Net returns	557	2,485	5,413	12,795
Average total costs per acre	18	13	12	11
Net returns per acre	1	3	4	5

These figures suggest that over 2,000 acres are needed if $5,000 is considered an adequate income for a farm family in this area. Mainly because of lower costs per acre, the 5,080-acre farm was again the most profitable (see last two lines of table).

As can be seen in the previous figures, depreciation on machinery and buildings and interest on investment are important costs that affect net returns. Should purchase price or salvage (selling) price be used in calculating these costs? Bucher and Quenemoen have raised this question in their study of four farm sizes in the "Triangle Area" of north central Montana.[24] Their study was based on a survey of 16 farms in an area noted

[24] Robert F. Bucher and M. E. Quenemoen, "Returns from Dryland Farming in the Triangle," mimeographed, Montana Agricultural Experiment Station (1967).

for its relatively uniform soils, topography, and yields. Additional information was secured regarding machinery sizes, capacities, and life from engineering reports. Using this information, least-cost budgets were prepared for four farms with 400 acres, 900 acres, 1,500 acres and 2,400 acres of cropland.

Regardless of the size of farms it was assumed that 65 percent of the seeded cropland was in wheat yielding 25 bushels an acre on summer fallow and 35 percent in barley yielding 33 bushels an acre. Estimated prices, including government payments, were $1.64 a bushel for wheat and $.80 a bushel for barley. Thus a constant mix of rotations, yields, practices, and operating costs was assumed for all four farms, but two land and machinery prices were used--acquisition and salvage.

Land purchase on acquisition price was set at $158 an acre. But salvage values ranged from $124 an acre for the smallest farm to $130 an acre for the largest because of selling costs. Machinery purchase on acquisition price was set at 10 percent more than investment value as usually calculated (new cost less scrap value divided by two), and sale or salvage price was set at 15 percent less than investment value. The total farm investment is strongly affected by this choice in land and machinery prices as can be seen in the land and machinery investment figures that follow:

Total acres	860	1,935	3,225	5,160
Acquisition	$150,000	$348,000	$583,000	$904,000
Salvage	117,000	278,000	471,000	737,000
Difference	33,000	70,000	112,000	167,000

The farmer's net returns for his labor and management at acquisition and salvage prices are shown in these figures:

Total acres	860	1,935	3,225	5,160
Cropland acres	400	900	1,500	2,400
At acquisition prices	$ -225	$ -392	$ -279	$ 3,368
At salvage prices	1,407	3,118	5,370	11,711

Perhaps the most important implication of this study is for young farmers who must pay acquisition prices for land and machinery. They will need at least 2,400 acres of cropland (5,200 total) to provide them with any hope of achieving a satisfactory level of living under the assumptions of this study.

Wheat-Fallow Farms in Wyoming

If federal public lands in Wyoming are to be made available for dryland wheat production, how large should these farms be if the farm family is to have an adequate income? Krenz and Miller determined the best management plans for six typical farm sizes in southeastern Wyoming where more

than 60 percent or more of its wheat is produced.[25]

Wheat accounts for only about 7 percent of total cash receipts of Wyoming farms and ranches. Nearly all of the wheat is grown in the ten eastern counties under dryland conditions. A wheat-fallow strip cropping system is generally used. Strips vary in width depending upon how susceptible the soil is to blowing. Hard red winter wheat is seeded in August or September on the summer fallow. Stubble on the harvested strips is left standing until the following spring to prevent soil blowing. When the fall seeding has grown enough to prevent wind erosion, the stubble is worked with large tractors and cultivators or rod weeders. Harvesting is done by pull-type or self-propelled combines.

Twenty-year average crop yields were used in the analysis of alternative plans. These yields which take crop losses into account were: wheat, 16 bushels per planted acre; barley, 21 bushels per planted acre. The wheat price used was $1.72 a bushel. Krenz and Miller analyzed the probable effects of nine possible wheat programs on six sizes of farms. A three-price program gave the highest net returns to the farmer for his labor and management on all farms. The gross returns, costs and net returns for the four largest farms were as follows:

Total acres in farm	480	795	1,400	3,870
Pasture acres	64	111	309	1,888
Cropland acres	416	684	1,091	1,982
Wheat allotment acres	126	205	329	548
Return to land and operator	$3,594	$6,047	$10,151	$21,924
Land charge	1,515	2,483	4,205	9,297
Net returns to operator	2,079	3,564	5,946	12,627
Net returns per acre	5.00	5.21	5.45	6.37
Labor (hours)	(643)	(971)	(1,908)	(4,233)
Labor returns per hour	3.23	3.67	3.12	2.98

The land charge consisted of 5 percent of the value of the land with cropland valued at $70 and pasture at $25 an acre.

Feeder calves were used in all farm plans and sheep were included in plans for the two largest farms where pasture was an important resource. The number of calves and sheep varied depending upon the cropping system used. With the addition of livestock enterprises, these four farms reflect other differences besides the changes in farm size, and therefore

[25] Ronald D. Krenz and Thomas A. Miller, Wheat Farming in Wyoming; (1) Characteristics and Clarification of Wheat Farms and (2) Profit Maximizing Plans for Specialized Wheat Farms in Southeast Wyoming, Wyoming Agricultural Experiment Station Bulletins 391 and 392 (1962).

the effects of size alone cannot be observed.

Of the four sizes studied the 3,870-acre farm produced the highest net returns. If $5,000 is assumed to be an adequate income for a farm family, then a farm of at least 1,200 acres would be needed under the conditions assumed in this study.

Wheat-Fallow Farms of Washington and Oregon

How large must wheat-fallow farms of central Washington and north central Oregon be in order to provide an adequate income for a farm family?

Goodsell and others have presented 1966 data for a typical 1,520-acre farm in this area that helps answer this question.[26] Of the 1,520 acres in this farm, 1,100 acres were cropland. There were 400 acres of winter wheat and 100 acres of other small grains. About 600 acres were summer fallowed. Crop yields per harvested acre were: wheat, 32.5 bushels; barley, 40.9 bushels; and hay, 1.2 tons. A dozen beef cows were kept and a dozen pigs raised.

Total farm capital was nearly $200,000. Machinery and equipment investment was $21,000, and land and buildings were valued at $167,000.

Total gross income was $34,325 of which wheat contributed $20,235. Thus the average gross income per acre was $22.50.

Total costs were $26,827 and include interest on investment at current rates. Total fixed costs of machinery were $3,500 and consisted of $2,237 for depreciation, $1,050 for interest on machinery investment at 5 percent and taxes, insurance and housing charges.[27] By subtracting the $3,500 total fixed costs from the $26,827 total costs, the total variable costs are found to be $23,327. For the 1,520-acre farm this is an average variable cost of $15.35 an acre.

The net returns from smaller farms can now be determined--assuming machinery costs are fixed and all other returns and costs vary directly with the acres farmed. Thus the net returns to the operator for his labor and management for a 1,000-acre and for a 1,250-acre farm as well as for the 1,520-acre typical farm would be as follows:

[26] Wylie D. Goodsell and others, Farm Costs and Returns, Commercial Farms by Type, Size and Location, U.S. Department of Agriculture, Agriculture Information Bulletin 230 (1968), pp. 66-67.

[27] Depreciation figure from Wylie D. Goodsell, Economic Research Service, U.S. Department of Agriculture (letter, 14 November 1968).

Total acres in farm	1,000	1,250	1,520
Cropland acres	720	900	1,100
Total gross returns	$22,500	$28,125	$33,750
Total fixed costs	3,500	3,500	3,500
Total variable costs	15,250	19,062	23,327
Total costs	18,750	22,562	26,827
Net returns	3,750	5,563	7,498
Labor (hours)	(2,260)	(2,812)	(3,420)
Returns per hour	$ 1.66	$ 1.98	$ 2.19
Average total costs per acre	26	25	24
Net returns per acre	5	6	7

Of these three farms the largest appears to be the most profitable because the total costs per acre are lowest on this farm (see last two lines of table). While it is possible that fixed costs might be reduced somewhat on the 1,000-acre farm, this analysis suggests that more than 1,000 acres would be needed to provide $5,000 for a farm family in this wheat-fallow area.

Wheat-Pea Farms in Idaho and Washington

What is the minimum size of a wheat-pea farm that will provide a satisfactory income for a farm family? Goodsell and others have presented costs and returns for a typical wheat-pea farm for 1957-59, 1964, 1965, and 1966 that are helpful in seeking an answer to this question.[28]

In 1966 the typical wheat-pea farm consisted of 615 acres of which 412 were harvested, and 148 were listed as "other cropland". The crops harvested, crop acres, crop yields per acre, and gross returns were as follows:

Crop	Acres	Yields	Gross returns
Wheat	189	59 bushels	$16,451
Peas	103	15 cwt.	7,061
Barley	94	52 bushels	---
Other crops	26	--	4,920
Pasture, etc.	203	Livestock income	3,210
All other income, including government payments			5,860
Total gross returns			37,502

[28] Wylie D. Goodsell and others, Farm Costs and Returns, Commercial Farms by Type, Size and Location, U.S. Department of Agriculture, Agriculture Information Bulletin 230 (1967), pp. 86-87.

The costs and net returns to the operator on this typical 615-acre farm were as follows:

Total gross farm income	$37,502
Total operating expenses	14,047
Interest on capital	13,009
Total costs	27,056
Net returns	10,446

To explore the income possibilities of other farm sizes the fixed ownership costs of the $24,870 invested in machinery needs to be separated from other costs. Goodsell reports that annual machinery depreciation on this farm was $3,178.[29] Interest on investment at 6 percent was another $1,500 making a total of $4,778. Taxes, insurance and housing would probably increase the total fixed costs to $5,000. Since total costs are $27,056, subtraction of the fixed costs leaves total variable costs of $22,056 or $36 an acre. With these figures, the gross returns, costs, and net returns for three other sizes of farms can now be calculated as follows:

Total acres in farm	200	400	500
Total gross returns	$12,200	$24,400	$30,500
Total fixed costs	5,000	5,000	5,000
Total variable costs	7,200	14,400	18,000
Total costs	12,200	19,400	23,000
Net returns	0	5,000	7,500
Labor (hours)	(940)	(1,880)	(2,350)
Returns per hour	$ 0	$ 2.66	$ 3.19
Average total costs per acre	61	48	46
Net returns per acre	0	12	15

It is evident that a farm of at least 400 acres is the minimum if $5,000 net returns for labor and management are considered an adequate farm income. It should be noted, however, that even on this size of farm the operator would not be fully employed.

Michalson also investigated farm size in the wheat-pea area of Washington and Idaho.[30] Using linear programming he found the least

[29] Wylie D. Goodsell, Economic Research Service, U.S. Department of Agriculture (letter, 14 November 1968).

[30] E. L. Michalson, Economics of Farm Size in the Washington-Idaho Wheat-Pea Area, Washington Agricultural Experiment Station Technical Bulletin 52 (1967).

cost plan for five farm sizes. The smallest size was a 600-acre farm with 522 acres of cropland. Gross returns, costs, and net returns on this farm were as follows:

Total gross returns	$34,400
Total fixed costs	20,334
Total variable costs	11,002
Total costs	31,336
Net returns	3,064

These net returns of $3,064 on Michalson's 600-acre farm are $7,400 less than the $10,446 net returns on Goodsell's typical wheat-pea farm of 615 acres. Higher fixed costs are largely responsible for this difference. Whatever the comparative merits of the two studies, Michalson lends little support to the idea of small, but efficient, farms. He found that all measures of income and efficiency increased as farms were enlarged from 600 to 1,600 acres and that net returns continued to increase up to 1,900 acres.

VII. SUMMARY AND CONCLUSIONS

What is the minimum amount of land needed to provide a farmer and his family with an adequate income? The main purpose of this study was to help the Public Land Law Review Commission answer this question. The Commission needs this information before it makes recommendations regarding the 160-acre and 320-acre limitations of the homestead acts and other laws concerned with the disposal of federal public lands for crop production.

But what is an adequate living? This question must be answered before the minimum amount of land is determined, and one purpose of this study was to provide information which will help the Commission define "adequate" income. Another was to provide information about the incomes that can be expected from farms of various sizes by reviewing some studies of farm size that have been made in the Western States.

Competition for labor and management plays an important role in determining what is considered an "adequate income" in any society. No society can long afford to encourage men to enter farming if they can contribute much more to society in some other line of work. It is generally true that a farmer making $5,000 or less, for example, is doing both himself and society harm if he can earn $8,000 or more in some other kind of work. Most farmers will not continue farming under these circumstances nor should the federal government encourage them to do so. On the contrary, the government should make it easy for such people to find employment where their abilities can be fully utilized. Hence, the federal government should not create small inadequate farms that neither provide full employment nor adequate incomes for farm families. To do so is to create rural slums.

In recent years the President's Council of Economic Advisors has been using $3,000 as the poverty line for family incomes. With this $3,000 as a base, economists have concluded that $5,200 is the poverty line for a family with three or four children when the oldest is 18 years of age or older.

In the United States 54 percent of the farms produced less than $5,000 worth of products in 1967. The realized net income of this group has averaged only $1,200 a year since 1960. Some 14 percent of the farmers produced $5,000 to $10,000 worth of products in 1967. This group has averaged only $3,500 a year since 1960. Another 32 percent of the farmers produce 85 percent of all farm products sold and receive 74 percent of the total net farm income. Their net incomes have ranged from $8,000 to $12,000 a year since 1960.

How much gross income is needed to produce $5,000 of net income? Because farm expenses average about 70 percent of gross income, about $16,000 of gross income is needed. The number of acres needed to produce this gross income depends upon the productivity of the land and the crops

grown. If the gross is $100 per acre, then 160 acres would be sufficient. Such a gross may be achieved in the heart of the Corn Belt, or under irrigated conditions, or when specialty crops are grown. If the gross is $50 an acre, then 320 acres would be needed. Such crop incomes are typical of the western edge of the Corn Belt. If the gross is only $25 an acre, then 640 acres are needed, and additional land may be needed for summer fallow. This latter gross income is typical of many dryland wheat producing areas.

Whether or not a gross of $16,000 will produce a net income of $5,000 depends upon the costs involved, and these vary widely from crop to crop and area to area. Careful analyses of both production possibilities and costs are needed to determine accurately the size of farm necessary to produce $5,000 of net income.

A number of studies of farm size made in Iowa and the Western States were reviewed to determine the incomes that various sizes of farms would produce. The relation of size of irrigated farm to net returns for labor and management is shown in Figure 10. When $3,000 is used as a poverty line, at least 160 acres of irrigated cropland are needed to prevent a poverty income. If $5,000 is used, nearly 300 acres of cropland would be needed to lift the net income above the poverty level.

It is of interest to compare the relationship of average net returns from Iowa dryland field crops with that of the irrigated farms further west. About 200 acres of cropland are needed to produce $3,000 of net returns under dryland conditions on upland farms in southern Iowa (Figure 10). These farms are about 33 percent larger than western irrigated farms because of pasture and other land unsuited for crops in this area of Iowa. These whole-farm figures are presented in Figure 11 for comparison with other dryland farms of the West which are also on a whole-farm basis. Thus, even in southern Iowa with 32-inch annual rainfall and a 160-day frost-free growing period, a 266-acre farm is needed to produce net returns of $3,000.

In the Western States with much less precipitation, higher elevation and shorter growing seasons, much larger farms are needed. For example, Wyoming wheat farms need at least 700 acres to achieve a $3,000 net return. If the poverty line is set at $5,000, farms in the Western States must exceed 1,200 acres in size. In Montana, over 2,600 acres are needed to produce $5,000 net income.

While studies of the economics of farm size reviewed are often based on varying assumptions regarding yields, prices and costs, the conclusion is inescapable that there can be no one minimum size of farm that will produce any given level of income that may be designated as "adequate" for a farmer and his family. If the Public Land Law Review Commission decides that $5,000 should be the minimum income, then the 160 and 320-acre limitations are, with few exceptions, too low to provide this amount.

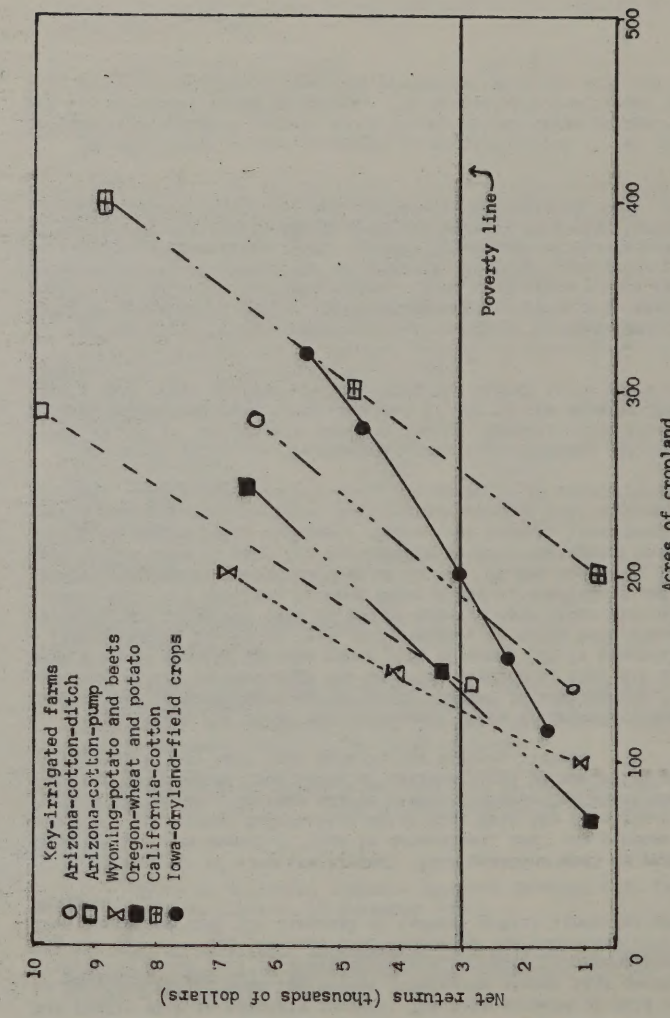

Figure 10.--Relationship between net returns to labor and management and acres of cropland for six farm size studies in Western United States

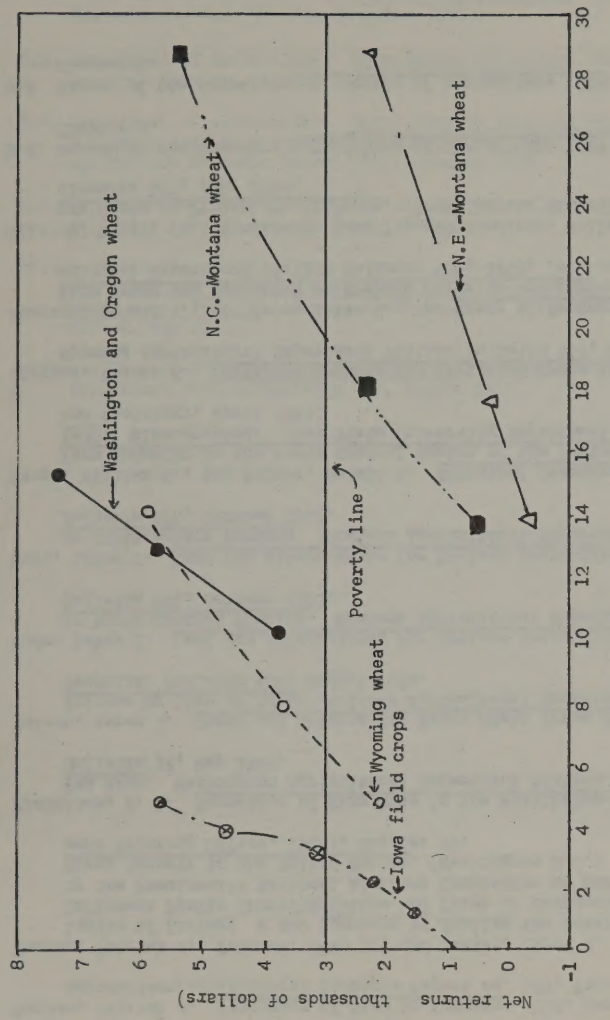

Figure 11.--Relationship between net returns to labor and management and total farm acreage for five dryland farm size studies in Western United States

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Federal Public Land Laws and Policies Relating to Intensive Agriculture

WORKING PAPER

Federal Public Lands Suited for Intensive Agriculture in Western United States

Prepared for the

Public Land Law Review Commission

Washington, D. C.

By

The Economics Department

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APRIL 30, 1969

REVISED OCTOBER 1969

CONTENTS

FEDERAL PUBLIC LANDS SUITED FOR INTENSIVE AGRICULTURAL DEVELOPMENT

Fred C. Westin and E. J. Daniel*

Introduction

Since 1781 the federal government has disposed of 1.043 million acres of public lands; however, federal agencies in the 17 Western States still administer 371 million acres of such lands. Most of these lands are used for livestock grazing and forestry while others are used for parks, wildlife and defense. Some are deserts and many are mountainous. How much of these remaining federal public lands are suited for intensive agriculture or crop production? This is an important question because present public laws still encourage farmers to attempt to settle on federal lands that frequently are not suited for agriculture.

The purpose of this report is to present estimates, by States, of the amount of public land suited for intensive agricultural development.** These estimates are based on available data and informed judgment and not on any new field investigations. The data, for the most part, were obtained from the agencies having administrative responsibility for the lands. In cases where data were not available from the agency concerned, projections were made from information furnished by the State Agricultural Experiment Stations and the Soil Conservation Service. Data were gathered and recorded from each State through personal contacts with the administrators of each agency and their technical people in that State.

Federal public lands deemed suitable for intensive agriculture were classified as (A) lands physically and economically suited for dryland crop production under prevailing management practices; (B) lands economically suited for irrigation and for which water is potentially available or expected to be available; and (C) lands suited for irrigation but for which water is not legally or physically available at present under existing patterns of water rights and water use.

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**Included are not only original public lands but also acquired lands such as land utilization project lands and/or National Grasslands.

A summary of the data for the 17 States in given in Table 1. Table 2 shows the totals by States and Table 3 by agency. Tables 4-20 are summaries of the data by agency and by State. Tables 21-38, in the Appendix, list the data for all of the individual projects of specific agencies in each State. In these Appendix tables, each table consists of six sections--one for each agency.

Regional Totals

In Table 1 the total acreage in the 17 Western States as a whole is shown for each of the three categories described previously. It is to be noted that over 90 percent of the land estimated as being suitable for intensive agriculture is in category C--lands suitable for irrigation but for which water is not presently available. Although much of the area of these 17 Western States is limited for intensive agriculture by topography and soils, there are fairly extensive plains whose soils are suitable for development. Water, rather than soil or topography, actually is the most limiting factor for intensive agricultural development in the West. If water were legally or physically available, it is estimated that about 35 million acres of these plains could be irrigated. Presently, these lands are used for grazing purposes or recreation, or they are idle.

The lands included in category A (suitable for dryland agriculture) total nearly two million acres. This acreage appears small, but the combination of semiarid to arid climate and generally rolling topography limits use of these lands for dryland farming. The lands do not occur in blocks but usually as narrow mountain valleys, colluvial slopes, or fans. In addition to their awkward and irregular shapes, they ordinarily occur in small parcels and often at rather high elevations. Here a short growing season and cool temperatures limit the choice of crops. For many of these areas hay production is the best and perhaps the most intensive use to which they could be adapted.

The lands included in category B total about 1.3 million acres. They occur mainly along streams and rivers or in areas underlain by aquifers. For the most part they are alluvial and terrace lands having deep soils and favorable topography. Limiting factors include irregular parcel size, salinity and seasonal wetness in some of the soils, and cool temperatures.

The figure for total land in Table 1 does not coincide exactly with the figure in Public Land Statistics, 1967 (45) since minor holdings are not included in all cases. Many of these minor holdings are buildings and parking grounds.

State Totals

In Table 2 the acreages of lands estimated to be suitable for intensive agriculture are listed, by States, in the three categories described in the Introduction. Table 2 indicates that the Plains States have relatively small acreages of public land. These range from 588,981 acres in Kansas to 2,338,738 acres in Texas while the acreage in each of the Mountain States, except Washington, generally exceeds 20 million. Although the Plains States have much smaller totals of public land, they have proportionally larger percentages of land in category A than the Mountain States. On the other hand, the Mountain States, except Montana, have higher percentages of land in category C versus those in A. These differences reflect the generally more humid environment of the Plains. In the Mountain States the areas with topography favorable for intensive agriculture are mostly dry, and only when water is supplied by artificial means can they be considered arable.

The Western States having the largest acreages of arable lands (category A) are Wyoming, Montana, Texas, the two Dakotas, California and Colorado. Each of these States has more than 100,000 acres in this category.

The States having the largest acreages of public land estimated to be irrigable (category B) include Wyoming, Washington, Idaho, and California. Each of these States has over 100,000 acres in this category. The States with the largest acreages in category C include Nevada, Arizona, and California, each having over six million acres estimated to be irrigable if water were available.

Agency Totals

Table 3 lists the estimated acres in each category under the agency which is administratively responsible for the land. Seven agencies are listed in Table 3, plus the National Grasslands (Land Utilization lands) which are listed as the eighth entry. The National Grasslands (Land Utilization lands) is not an administrative agency--these lands are administered either by the Forest Service or the Bureau of Land Management.

Table 3 also includes for each category the percentages of total lands administered by the various agencies; for example, the Bureau of Reclamation has 22,972 acres considered arable--0.25 percent of total lands administered by that agency (8,977,277 acres) in the 17 Western States. Totals for the agencies in each State appear in Tables 4 through 21.

The percentages of land considered suitable for dryland agriculture range, among agencies, from 0.15 percent for National Park lands to 3.07 percent for Corps of Civil Engineers lands. National Grasslands (Land Utilization lands) were considered 8.39 percent arable. These lands, accounted for in the Bureau of Land Management and Forest Service figures, are mostly in the plains area where more favorable soils, topography, and climate make them more adapted for dryland agriculture than are the mountains and deserts of the West.

So far as total acres of land suitable for dryland agriculture are concerned, it is apparent from Table 3 that the Forest Service and the Bureau of Land Management account for over two-thirds of the acreage reported.

In category B, Table 3 indicates that the percentages of lands suitable for irrigation and for which water is available range from 0.03 percent for the Corps of Civil Engineers and National Park Service to 4.72 percent for the Bureau of Reclamation. The Bureau of Land Management and the Bureau of Reclamation together account for over 70 percent of the land reported in this category.

In category C, Table 3 lists the percentages of lands suitable for irrigation but for which water is not available as ranging from 0.29 percent for the Corps of Civil Engineers to 23.92 percent for the Department of Defense. Although the Department of Defense has the largest percentage, it reports only about 13 percent of the total lands. The Bureau of Land Management controls about 80 percent of the lands in this category. In Tables 4 through 20, it can be seen that these lands are mainly in Nevada, Arizona, California, New Mexico, and Idaho. These five States have nearly 82 percent of the total land in category C.

Agency Totals Listed by State

Tables 4 through 20 are breakdowns of agency lands within each State. The States are arranged alphabetically with Arizona data in Table 4 and Wyoming data in Table 20. These tables show the acreages in each of the three categories defined in the Introduction. Also included are figures for the estimated fair market value of some of the lands in categories A and B. Estimated values for other A and B lands were not attempted since there have been few sales of similar lands in the area.

The estimated value figures of lands in category B are subject to many limitations. Soils and topography vary, resulting in a range of land classes. Moreover, the environmental factors of climate and local site result in a wide range of conditions for crop growth. Very

favorable soils may occur at high elevations where low temperatures restrict the choice of crop. Nearness to a market is a third variable. Generally class I and II soils, if they occur in a favorable climatic environment and are located where the crop can be marketed, are valued at $1,000 an acre or even as high as $1,500 an acre. These lands occur in Arizona and California along the southern margin of the region. An average figure for the central part of the region for class I and II land is $500 to $900 per acre. Along the northern margins of the region and for class III land generally, the estimated market price per acre ranges from $250 to $500 per acre.

The estimated market value of lands suited for dryland agriculture is as low as $45 or $50 per acre for land suited only for hayland in the drier or colder parts of the region. Estimates up to $300 or $350 per acre were made for the areas having little relief, deep soils, and a relatively moist, warm climate.

Subdivisions of Agencies for Each State

Each agency responsible for public lands within a State has a number of projects varying from one or two to many. The estimated acreage figures for these projects were the starting points in the data collecting process and furnish the raw data upon which this report was constructed. Because of their bulk, these tables were placed in the Appendix. They are designated by numbers from 21 for Arizona to 38 for Wyoming, and each table has six sections. Arizona tables, for example, are designated 21-1 (Bureau of Reclamation); 21-2 (Bureau of Land Management); and so on through 21-6. Thus the Appendix actually consists of 102 tables, each containing a list of the individual projects under each agency. Most agencies have around six projects but some, like the National Park Service in Arizona, have as many as 20.

Sources of Data

As stated in the Introduction, the data appearing in the estimates were obtained, for the most part, from the agency having administrative responsibility for the land. In cases where these data were not available, as in most of the Department of Defense land, the figures were obtained by matching the lands in question to a soil map for which soil classification data were available.

Considerable progress has been made in some States toward obtaining data on irrigation suitability regardless of the ownership of the land. One project of this nature is the Columbia-North Pacific Comprehensive Study which is cited in preliminary form (55). Other

studies which are not yet in final form are the River Basin studies (70-72). When completed, these will provide data on the irrigability of lands surveyed.

The references listed in the Bibliography are arranged in the following manner:

1 through 4	U.S. maps showing data for the 17 Western States.
5 through 8	Regional maps showing public lands crossing State boundaries.
9 through 36	State maps showing public lands.
37 through 53	General references including land use data, bibliographies of published soil surveys, public land statistics, North Central and Western regional soils publications and similar materials.
54 through 59	Regional references including a preliminary draft copy of the Comprehensive Framework Study of the Columbia Basin and Northwest Pacific, Irrigation Land Classes, Land Classification Specifications for the Pacific Southwest Basin, and climatic data.
60 through 86	State references including State soil publications and conservation needs inventories.

The references cited were used to supplement the data obtained directly from the agencies and to aid in extending knowledge to lands about which little was known.

Table 1.--Estimated total acres of federal public lands suitable for intensive agriculture in the 17 Western States[a]

Description of land	Acres	Percent
A. Arable--dryland	1,995,604	5.2
B. Irrigable--water available	1,312,639	3.4
C. Irrigable--water not legally or physically available at present	35,068,041	91.4
Total[b]	38,376,284[b]	100.0

[a]Included are some acquired lands, see note Volume I, page 1.

[b]This is 10.5 percent of the 365 million acres of public lands in the 17 Western States that are included in this inventory.

Table 2.--Estimated total acreage of federal public lands suitable for intensive agriculture controlled by seven agencies in the 17 Western States, by States

State	Public lands total acres	A Dryland acres	B Irrigable (water avail.) acres	C Irrigable (water not avail.) acres
Arizona	33,033,826	0	10,775	7,145,106
California	44,676,678	172,216	136,877	6,128,681
Colorado	23,021,905	103,420	87,795	298,120
Idaho	31,586,491	84,895	313,777	2,622,642
Kansas	588,981	99,415	43,000	210
Montana	26,914,155	279,160	5,600	13,270
Nebraska	636,420	9,599	4,900	26,454
Nevada	60,639,011	3,805	6,894	9,915,714
New Mexico	26,100,312	203	11,443	2,921,542
North Dakota	2,154,276	261,665	4,412	3,700
Oklahoma	1,154,838	43,762	3,485	44,891
Oregon	29,617,935	67,142	72,057	625,301
South Dakota	3,294,588	236,564	46,176	96,868
Texas	2,338,738	149,140	6,205	189,542
Utah	35,217,787	634	13,621	2,557,340
Washington	13,817,828	14,884	158,230	41,870
Wyoming	30,656,139	469,100	387,392	2,436,790
	365,449,908	1,995,604	1,312,639	35,068,041

Note: Agencies with their total acreages are shown in Table 3.

Table 3.--Estimated total acreage of federal public lands suitable for intensive agriculture in the 17 Western States, by Agency

Administered by	A Dryland Acres	A Dryland Percent[a]	B Irrigable (water avail.) Acres	B Irrigable (water avail.) Percent[a]	C Irrigable (water not avail.) Acres	C Irrigable (water not avail.) Percent[a]
Bureau of Reclamation	22,972	0.25	423,936	4.72	370,725	4.13
Bureau of Land Management	569,320	0.32	516,265	0.30	28,449,555	16.26
National Parks	21,383	0.15	4,816	0.03	696,100	4.89
Sport Fisheries and Wildlife	82,940	1.60	114,367	2.20	58,451	1.13
Forest Service	842,439	0.60	100,830	0.07	932,750	0.67
Department of Defense	343,650	1.81	151,425	0.79	4,549,860	23.92
Corps of Civil Engineers	112,900	3.07	1,000	0.03	10,600	0.29
Totals	1,995,604		1,312,639		35,068,041	
National Grasslands and/or L.U. lands[b]	509,880	8.39	115,006	1.89	557,581	8.70

[a]Percentage of total lands administered in specified category.

[b]Acres and percentages have been included in Bureau of Land Management and/or Forest Service figures.

Table 4.--Arizona: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	1,389,957	0	---	6,000	$ 405	105,100
Bureau of Land Management	12,925,990	0	---	0	---	4,700,000
National Park Service	2,098,512	0	---	220	75	430,006
Sport Fisheries and Wildlife	1,599,361	0	---	4,375	450	6,000
Forest Service	11,377,229	0	---	180	1,500	20,000
Department of Defense	3,608,969	0	---	0	---	1,879,000
Corps of Civil Engineers	33,808	0	---	0	---	5,000
Total	33,033,826	0	---	10,775	---	7,145,106
National Grasslands/ L. U. lands[a]	38,832	0	---	0	---	38,832

Sources: (9), (10), (11), (60), (61)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 5.--California: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	1,121,136	4,110	$150	20,260	450-$1,000	140,620
Bureau of Land Management	16,815,998	0	---	0	---	4,400,000
National Park Service	4,119,390	1,716	395	1,516	690	1,716
Sport Fisheries and Wildlife	78,895	1,118	---	27,101	---	13,495
Forest Service	18,754,900	272	---	0	---	17,850
Department of Defense	3,709,735	165,000	---	88,000	---	1,555,000
Corps of Civil Engineers	76,624	0	---	0	---	0
Total	44,676,678	172,216	---	136,877	---	6,128,681
National Grasslands/ L. U. lands[a]	19,115	0	---	0	---	9,000

Sources: (12), (62), (63), (64), (65)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 6.--Colorado: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	806,266	2,000	$ ---	13,449	$300	0
Bureau of Land Management	8,294,635	101,420	20-100	72,420	150-295	121,820
National Park Service	87,297	0	---	0	---	17,000
Sport Fisheries and Wildlife	24,424	0	---	1,926	---	3,300
Forest Service	13,544,583	0	---	0	---	140,000
Department of Defense	238,496	0	---	0	---	16,000
Corps of Civil Engineers	26,204	0	---	0	---	0
Total	23,021,905	103,420	---	87,795	---	298,120
National Grasslands/ L. U. lands[a]	612,189	0	---	0	---	140,000

Sources: (13), (14), (66), (68), (69), (70), (71), (72)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 7.--Idaho: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	453,046	200	---	146,240	$400	0
Bureau of Land Management	11,957,000	82,800	$ 45-100	160,100	---	2,474,200
National Park Service	53,630	20	300	20	400	20
Sport Fisheries and Wildlife	50,513	1,492	40-150	7,192	100-600	122
Forest Service	18,341,510	383	130	225	---	28,300
Department of Defense	691,035	0	---	0	---	120,000
Corps of Civil Engineers	39,757	0	---	0	---	0
Total	31,586,491	84,895	---	313,777	---	2,622,642
National Grasslands/ L. U. lands[a]	120,599	5,000	---	15,006	---	70,000

Sources: (15), (16), (17), (18), (19), (59), (73)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 8.--Kansas: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	Arable lands (dryland)		Irrigable lands (water avail.)		Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	17,173	1,765	$200	0	---	0
Bureau of Land Management	1,511	0	---	0	---	0
National Park Service	1,156	150	---	0	---	210
Sport Fisheries and Wildlife	39,700	2,500	130	0	---	0
Forest Service	107,255	43,000	100	43,000	250	0
Department of Defense	163,808	27,600	150	0	---	0
Corps of Civil Engineers	258,378	24,400	60	0	---	0
Total	588,981	99,415	---	43,000	---	210
National Grasslands/ L. U. lands[a]	107,255	43,000	---	43,000	---	0

Source: (74)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 9.--Montana: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	323,191	12,000	$110	5,200	$325	0
Bureau of Land Management	8,071,610	87,900	35	0	---	8,900
National Park Service	1,137,052	2,000	---	0	---	4,270
Sport Fisheries and Wildlife	112,001	7,260	60-500	400	300	100
Forest Service	16,609,099	165,000	75	0	---	0
Department of Defense	12,593	0	---	0	---	0
Corps of Civil Engineers	588,609	5,000	---	0	---	0
Total	26,914,155	279,160	---	5,600	---	13,270
National Grasslands/ L. U. lands[a]	1,900,637	41,000	---	0	---	0

Sources: (20), (21), (59)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 10.--Nebraska: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	66,907	600	---	1,000	---	0
Bureau of Land Management	7,948	100	---	0	---	600
National Park Service	4,321	550	---	0	---	600
Sport Fisheries and Wildlife	74,586	4,649	---	2,200	---	54
Forest Service	349,399	0	---	0	---	20,000
Department of Defense Corps of Civil Engineers	79,223	3,700	---	1,700	---	5,200
	54,036	0	---	0	---	0
Total	636,420	9,599	---	4,900	---	26,454
National Grasslands/ L. U. lands[a]	103,985	0	---	0	---	20,000

Source: (75)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 11.--Nevada: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	1,171,027	0	---	2,500	$500	80,500
Bureau of Land Management	48,067,085	0	---	0	---	9,613,414
National Park Service	692,327	0	---	0	---	50,000
Sport Fisheries and Wildlife	1,700,329	80	---	654	---	2,800
Forest Service	5,062,930	0	---	15	---	4,000
Department of Defense Corps of Civil Engineers	3,944,293	3,725	---	3,725	---	165,000
	1,020	0	---	0	---	0
Total	60,639,011	3,805	---	6,894	---	9,915,714
National Grasslands/ L. U. lands[a]	3,287	0	---	0	---	600

Sources: (22), (23), (24), (59)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 12.--New Mexico: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	197,842	0	---	0	---	5,000
Bureau of Land Management	13,682,908	0	---	0	---	2,233,201
National Park Service	239,645	0	---	0	---	13,921
Sport Fisheries and Wildlife	146,835	203	$150	7,054	$150-550	2,420
Forest Service	8,922,268	0	---	4,389	---	67,000
Department of Defense	2,897,488	0	---	0	---	597,400
Corps of Civil Engineers	13,326	0	---	0	---	2,600
Total	26,100,312	203	---	11,443	---	2,921,542
National Grasslands/ L. U. lands[a]	361,353	0	---	4,000	---	26,009

Sources: (25), (26)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 13.--North Dakota: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	58,706	0	---	0	---	0
Bureau of Land Management	75,785	3,800	---	0	---	0
National Park Service	69,000	5,760	---	0	---	0
Sport Fisheries and Wildlife	283,666	39,135	$80-155	4,412	$60-275	3,700
Forest Service	1,104,958	183,680	---	0	---	0
Department of Defense	12,174	10,790	---	0	---	0
Corps of Civil Engineers	549,987	18,500	---	0	---	0
Total	2,154,276	261,665	---	4,412	---	3,700
National Grasslands/ L. U. lands[a]	1,104,958	183,680	---	0	---	0

Sources: (27), (79)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 14.--Oklahoma: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	73,158	325	---	0	---	35
Bureau of Land Management	17,868	1,200	---	0	---	1,000
National Park Service	6,558	500	$110	0	---	1,100
Sport Fisheries and Wildlife	115,829	4,237	190-350	485	$400-500	2,876
Forest Service	46,838	0	---	3,000	150	1,500
Department of Defense	182,688	36,500	---	0	---	36,380
Corps of Civil Engineers	711,899	1,000	---	0	---	2,000
Total	1,154,838	43,762	---	3,485	---	44,891
National Grasslands/ L. U. lands	46,838	0	---	3,000	---	1,500

Source: (80)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 15.--Oregon: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	147,573	535	$100	22,540	$325	11,500
Bureau of Land Management	13,573,038	59,100	---	0	---	537,600
National Park Service	160,890	10	300	0	---	0
Sport Fisheries and Wildlife	534,298	4,837	200-700	49,517	525	14,101
Forest Service	15,039,602	2,660	70-100	0	---	62,100
Department of Defense	67,567	0	---	0	---	0
Corps of Civil Engineers	94,967	0	---	0	---	0
Total	29,617,935	67,142	---	72,057	---	625,301
National Grasslands/ L. U. lands[a]	81,542	0	---	0	---	10,000

Sources: (28), (29), (82)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 16.--South Dakota: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	value/ acre	Acres
Bureau of Reclamation	45,769	0	---	0	---	0
Bureau of Land Management	277,900	30,000	$ 50	0	---	3,000
National Park Service	142,141	1,000	$50-75	0	---	5,000
Sport Fisheries and Wildlife	62,404	8,729	---	1,176	---	5,168
Forest Service	1,979,148	186,000	60-150	45,000	---	80,000
Department of Defense Corps of Civil Engineers	268,440	9,835	---	0	---	2,700
	518,786	1,000	---	0	---	1,000
Total	3,294,588	236,564	---	46,176	---	96,868
National Grasslands/ L. U. lands[a]	856,691	186,000	---	45,000	---	80,000

Sources: (31), (83)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 17.--Texas: Estimated acres and values of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	61,504	0	---	0	---	0
Bureau of Land Management	0	0	---	0	---	0
National Park Service	945,621	0	---	0	---	135,547
Sport Fisheries and Wildlife	142,603	6,440	$135-330	1,205	$250-400	1,715
Forest Service	117,269	1,200	---	5,000	---	4,000
Department of Defense Corps of Civil Engineers	458,335	80,500	---	0	---	48,280
	613,406	61,000	70-200	0	---	0
Total	2,338,738	149,140	---	6,205	---	189,542
National Grasslands/ L. U. lands[a]	117,269	1,200	---	5,000	---	4,000

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 18.--Utah: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	1,671,113	0	---	1,100	$450	500
Bureau of Land Management	22,994,469	0	---	0	---	2,415,000
National Park Service	620,438	527	$30	0	---	27,640
Sport Fisheries and Wildlife	90,587	0	---	2,500	250	300
Forest Service	7,937,673	107	---	21	---	3,000
Department of Defense	1,903,507	0	---	10,000	---	110,900
Corps of Civil Engineers	0	0	---	0	---	0
Total	35,217,787	634	---	13,621	---	2,557,340
National Grasslands/ L. U. lands[a]	18,966	0	---	0	---	9,640

Sources: (32), (33), (34), (84), (85)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 19.--Washington: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	446,502	1,337	$225	102,800	$475	0
Bureau of Land Management	273,647	0	---	0	---	25,000
National Park Service	1,229,520	6,150	---	3,060	---	5,070
Sport Fisheries and Wildlife	82,111	2,260	200-800	3,370	525-900	800
Forest Service	10,937,553	137	---	0	---	0
Department of Defense	756,529	3,000	---	48,000	---	11,000
Corps of Civil Engineers	91,996	2,000	---	1,000	---	0
Total	13,817,828	14,884	---	158,230	---	41,870
National Grasslands/ L. U. lands[a]	725	0	---	0	---	0

Sources: (35), (59), (86)

[a]Included in Bureau of Land Management and/or Forest Service figures.

Table 20.--Wyoming: Estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total acres	A Arable lands (dryland)		B Irrigable lands (water avail.)		C Irrigable lands (water not avail.)
		Acres	Value/ acre	Acres	Value/ acre	Acres
Bureau of Reclamation	946,407	100	---	102,847	$300	27,470
Bureau of Land Management	17,870,000	203,000	---	283,745	---	1,915,820
National Park Service	2,605,544	3,000	---	0	---	4,000
Sport Fisheries and Wildlife	38,255	0	---	800	---	1,500
Forest Service	9,167,561	260,000	---	0	---	485,000
Department of Defense Corps of Civil Engineers	28,372	3,000	---	0	---	3,000
	0	0	---	0	---	0
Total	30,656,139	469,100	---	387,392	---	2,436,790
National Grasslands/ L. U. lands[a]	582,185	50,000	---	0	---	125,000

Sources: (36), (59)

[a]Included in Bureau of Land Management and/or Forest Service figures.

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APPENDIX

Table 21-1.--Arizona: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
All projects administered from Boulder City, Nevada*	1,298,700	0	---	6,000	405	105,000
Glen Canyon	91,257	0	---	0	---	0

*Includes lands in pending revocation of Reclamation withdrawal within Lake Mead Reclamation Area. Contact was W. S. Phillips, Boulder City, Nevada, August 23, 1968.

Table 21-2.--Arizona: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Arizona Strip	2,805,936	0	---	0	---	700,000
Phoenix	8,788,120	0	---	0	---	3,500,000
Safford	1,331,934	0	---	0	---	500,000
Totals	12,925,990	0	---	0	---	4,700,000*

Based on interpretation of map of potentially irrigable land by Task Force of the Land Use and Management Work Group for the Lower Colorado Region. *BLM figures for irrigable land (water not avail.): 3,589,622 acres.

Table 21-3.--Arizona: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Casa Grande Ruins	473	0	---	0	---	310
Chiricahua, N. M.	10,559	0	---	0	---	250
Coronado, N. M.	2,834	0	---	0	---	60
El Morro, N. M.	960	0	---	0	---	500
Fort Bowie, N. H. S.	900	0	---	200	50	400
Glen Canyon, N. R. A.	74,125	0	---	0	---	6,500
Grand Canyon, N. M.	193,019	0	---	0	---	50,000
Grand Canyon, N. P.	673,203	0	---	0	---	150,000
Gran Quivira, N. M.	611	0	---	0	---	611
Lake Mead, N. R. A.	600,000	0	---	0	---	0
Montezuma Castle	783	0	---	20	150	75
Navajo, N. M.	360	0	---	0	---	0
Organ Pipe, N. M.	328,691	0	---	0	---	150,000
Petrified Forest, N. P.	94,189	0	---	0	---	43,000
Saguaro, N. M.	76,828	0	---	0	---	8,000
Sunset Crater, N. M.	3,040	0	---	0	---	0
Tonto, N. M.	1,120	0	---	0	---	300
Tuzigoot, N. M.	43	0	---	0	---	0
Walnut Canyon, N. M.	1,642	0	---	0	---	0
Wupatki, N. M.	35,232	0	---	0	---	20,000
Total	2,098,512	0	---	220	75	430,006

Contact: Eslie H. Lampi, N. P. S. SW Region, Santa Fe, New Mexico. Data based on judgment of Resources Management Staff personnel, N. P. S., October 22, 1968.

Table 21-4.--Arizona: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Cabeza Prieta	860,040	0	---	0	---	0
Cibola	12,058	0	---	3,500	550	3,000
Havasu Lake	41,457	0	---	625	300	3,000
Imperial	25,764	0	---	250	620	0
Kofa	660,042	0	---	0	---	0
Totals	1,599,361	0	---	4,375	---	6,000

Contacts: W. T. Krummes, Regional Director and J. J. Harmon, Assistant Regional Director, October 15, 1968.

Table 21-5.--Arizona: U.S. Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Apache	1,191,765	0	---	30	500	0
Coconiuo	1,807,761	0	---	99	1,500	4,000
Coronado	1,720,936	0	---	0	---	0
Kaibab	1,719,346	0	---	0	---	1,000
Prescott	1,248,454	0	---	10	1,000	3,000
Sitgreaves	802,782	0	---	0	---	11,000
Tonto	2,886,185	0	---	41	500	1,000
Total	11,377,229	0	---	180	1,000	20,000

Contact: D. D. Cutler, Assistant Regional Forester, November 22, 1968. Criteria used were soil surveys.

Table 21-6.--Arizona: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	1,031,302	0	---	0	---	206,000
Air Force	2,574,441	0	---	0	---	1,673,000
Navy	3,226	0	---	0	---	0
Total	3,608,969	0	---	0	---	1,879,000
Corps of Civil Engineers	33,808	0	---	0	---	5,000

Data based on interpretation map of potentially irrigable soils made by Task Force of the Land Use and Management Work Group for the Lower Colorado Region (Billy Seay).

Table 22-1.--California: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Cachuma	10,308	0	---	0	---	100
Solano	29,503	700	100	0	---	100
Santa Maria	4,760	0	---	0	---	300
Ventura	7,007	0	---	0	---	0
Orland	7,344	395	150	0	---	0
Central Valley	185,140	1,160	150	2,630	1,000	0
Washoe	6,619	0	---	0	---	0
Klamath	122,466	1,855	150	17,630	450	920
Truckee Storage	2,001	0	---	0	---	0
Boulder City	734,200	0	---	0	---	139,200
Totals	1,121,136	4,110	150	20,260	---	140,620

Contact: W. E. Taggert, Chief of Land Management, Sacramento. Estimates supported by land classification and judgment of BR personnel.

Table 22-2.--California: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Ukiah	457,476	0	---	0	---	5,000
Redding	354,485	0	---	0	---	20,000
Susanville	1,264,631	0	---	0	---	70,000
Folsom	649,528	0	---	0	---	5,000
Bakersfield	4,706,233	0	---	0	---	1,500,000
Riverside	9,383,645	0	---	0	---	2,800,000
Totals	16,815,998	0	---	0	---	4,400,000

Contact: Howard Richmond, River Basin Planner. Data were developed by visually comparing land ownership maps and soils maps using Type I River Basin acreage estimates on hydrologic units.

Table 22-3.--California: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Cabrillo	80	0	---	0	---	0
Channel Island	18,170	0	---	0	---	0
Death Valley	1,767,760	0	---	0	---	0
Devil's Postpile	800	25	1,000	25	---	25
John Muir	10	5	2,750	5	---	5
Joshua Tree	511,580	0	---	0	---	0
King's Canyon	459,470	40	400	40	---	40
Lassen Volcano	106,280	0	---	0	---	0
Lava Beds	46,240	200	400	0	---	200
Muir Woods	480	6	---	0	---	6
Pinnacles	13,620	0	---	0	---	0
Point Reyes	32,220	0	---	0	---	0
Sequoia	385,410	0	---	0	---	0
Whiskey Town S. T.	18,190	100	---	100	---	100
Yosemite	759,080	1,340	---	1,340	---	1,340
Totals	4,119,390	1,716	400	1,516	690	1,716

Contact: Merle E. Stitt, Acting Assistant Regional Director, National Park Service Francisco, November 7, 1968. Data estimated by regional specialists.

Table 22-4.--California: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Klamath Basin*	10,295	0	---	0	---	0
Modoc	6,150	0	---	3,590	500	0
Kern- Pixley	14,789	0	---	3,200	200	11,589
Sacramento	23,040	1,118	300	15,511	600	1,906
Salton Sea (acquire)	8,986	0	---	0	---	0
San Luis	7,360	0	---	600	600	0
Merced	2,561	0	---	2,100	600	0
Salton Sea (domain)	4,116	0	---	2,020	900	0
Totals	77,297	1,118	---	27,021	---	13,495

Contact: John D. Findlay, Division of Wildlife Refuges, Portland, Oregon. Data based on soil surveys and judgment of specialists.
*A group of refuges -- some in Oregon.

Table 22-5.--California: U.S. Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Angeles	648,873	43	---	0	---	500
Cleveland	393,220	72	---	0	---	1,000
Eldorado	652,629	0	---	0	---	2,000
Inyo	1,835,937	0	---	0	---	200
Klamath	1,696,959	87	---	0	---	0
Lassen	1,045,587	5	---	0	---	400
Los Padres	1,724,026	22	---	0	---	600
Mendocino	872,287	0	---	0	---	0
Modoc	1,689,777	1	---	0	---	200
Plumas	1,146,745	1	---	0	---	0
San Bernadino	435,812	8		0	---	500
Sequora	1,115,596	0	---	0	---	0
Shasta Trinity	2,067,255	27	---	0	---	500
Sierra	1,294,113	1	---	0	---	1,000
Six Rivers	939,713	4	---	0	---	500
Stanislaus	896,292	0	---	0	---	250
Tahoe	697,015	7	---	0	---	1,000
Tio Yahe	629,536	0	---	0	---	200
Butte Valley	18,315	0	---	0	---	9,000
San Joaquin	800	0	---	0	---	0
Total	18,754,900	272	---	0	---	17,850

Contact: Joseph V. Flynn, Assistant Regional Director, Forest Service, September 16, 1968. Data estimated by specialists.

Table 22-6.--California: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	979,888	68,000	---	34,000	---	680,000
Air Force	469,191	31,000	---	21,000	---	325,000
Navy	2,253,063	66,000	---	33,000	---	550,000
Atomic Energy Commission	3,709,735	165,000	---	88,000	---	1,555,000
Corps of Civil Engineers	77,624					

Estimates for these data taken from detailed studies, from general map reports, River Basin Surveys, and knowledge of the area. Estimates furnished by SCS, Berkeley, California, November 27, 1968.

[a]These lands primarily are peripheral areas around reservoirs.

Table 23-1.--Colorado: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Lands administered from Salt Lake City office						
Cliffs Divide	3,686	0	---	0	---	0
Collbran	3,949	0	---	0	---	0
Fruit Growers	565	0	---	0	---	0
Grand Valley	3,432	0	---	0	---	0
Nancos	834	0	---	0	---	0
Pine River	3,696	0	---	0	---	0
Animos LaPlata	2,833	0	---	0	---	0
Bostwick	810	0	---	0	---	0
Cross Mt. Unit	27,265	0	---	0	---	0
Curecanti Unit	46,097	0	---	0	---	0
Dewey Unit	21,972	0	---	0	---	0
Delores	5,120	0	---	0	---	0
Ecko Park Unit	98,245	0	---	0	---	0
Florida	2,011	0	---	0	---	0
Fruitland Mesa	22,554	0	---	7,749	300	0
Nado Unit	23,990	0	---	0	---	0
Navajo	5,469	0	---	0	---	0
Paonia	2,757	0	---	0	---	0
Savory Pot Rook	23,750	2,000	---	5,700	250	0
Silt	1,492	0	---	0	---	0

Table 23-1.--(cont.) Colorado: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Projects	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Smith Fork	774	0	---	0	---	0
Whitewater	28,133	0	---	0	---	0
Uncompahgre	14,330	0	---	0	---	0
West Divide	739	0	---	0	---	0
Yampa White	2,782	0	---	0	---	0
Juniper	11,202	0	---	0	---	0
Transmission	9,550	0	---	0	---	0
Lands administered from Denver office						
Region 7	477,779	0	---	0	---	0
Totals	806,266	2,000	---	13,449	---	0

Contacts: Henry J. Hoff, Chief, Land Resource and Soils Laboratory, Denver; Les Butterfield, Chief of Land Branch; Paul Schaffer, Chief of Land Resources, Salt Lake City. Approximately 90-95% of area is water surface acreage suitable for agriculture production.

Table 23-2.--Colorado: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Craig District	2,843,122	95,000	100	24,400	150	45,400
Glenwood Springs	677,792	920	100	660	245	73,420
Montrose	2,267,217	1,000	40	36,000	150	3,000
Canon City	1,215,136	4,500	20	8,500	200	0
Grand Junction	1,291,368	0	---	2,860	150	0
State Total	8,294,635	101,420	---	72,420	---	121,820

Contacts: E.I. Rowland, State Director, Denver, Colorado. Andri Sent, Chief, Branch of Land Acquisition and Exchange. Data were developed by specialists from "Water and Related Resources White River Basin" study and Impact Report for proposed Bureau of Reclamatio projects.

Table 23-3.--Colorado: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Great Sand Dunes	35,530	0	---	0	---	14,500
Hovenweep	505	0	---	0	---	100
Mesa Verde	51,252	0	---	0	---	2,400
Yucca House	10	0	---	0	---	0
Totals	87,297	0	---	0	---	17,000

Contacts: Monte E. Fitch, Acting Assistant Regional Director of Operations, Santa Fe, New Mexico; Eslie H. Lampi, Division of Lands, Santa Fe, New Mexico. Estimated acreages provided by National Park Service personnel of Santa Fe, New Mexico.

Table 23-4.--Colorado: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Alamosa	7,615	0	---	300	150	200
Browns Park	3,262	0	---	1,306	150	1,100
Monte Vista	13,547	0	---	320	250	2,000
Total	24,424	0	---	1,926	---	3,300

Contact: William T. Krummes, Regional Director, Albuquerque, New Mexico
Data were developed by specialists and field managers of Bureau of Sport Fisheries and Wildlife.

Table 23-5.--Colorado: U.S. Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Arapaho	1,003,373	0	---	0	---	0
Grand Mesa	1,317,968	0	---	0	---	0
Gunnison	1,662,860	0	---	0	---	0
Pike	1,106,101	0	---	0	---	0
Fountain Creek	560	0	---	0	---	0
Rio Grande	1,799,389	0	---	0	---	0
Pawnee	193,100	0	---	0	---	0
Routt	1,125,045	0	---	0	---	40,000
San Isabel	1,106,510	0	---	0	---	0
Comanchee	419,089	0	---	0	---	0
San Juan	1,850,405	0	---	0	---	100,000
White River	1,960,183	0	---	0	---	0
Total	13,544,583	0	---	0	---	0
L. U./National Grasslands						140,000
Pawnee	193,100	0	---	0	---	40,000
Comanchee	419,089	0	---	0	---	100,000
Total	612,189	0	---	0	---	140,000

Contact: Earl Hendrickson, Assistant Regional Forester, Denver, Colorado. Data were developed by Forest Service personnel of Denver office.

Table 23-6.--Colorado: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	148,447	0	---	0	---	15,000
Air Force	27,048	0	---	0	---	1,000
Navy	63,001	0	---	0	---	0
Total	238,496	0	---	0	---	16,000
Corps of Civil Engineers	26,204	0	---	0	---	0

Contact: Frederick R. Conner, Chief, Management and Disposal Branch, Omaha, Nebraska. Estimates for these data taken from detailed studies, from general map reports, River Basin Surveys, and knowledge of the area.

Table 24-1.--Idaho: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
*Boise	99,574	200	225	40	350	0
*Minidoka	119,673	0	---	7,200	400	0
*Sooth West Idaho	193,515	0	---	139,000	400	0
*General Investigations	1,573	0	---	0	---	0
*Mann Creek	1,116	0	---	0	---	0
*Challis	760	0	---	0	---	0
*Palisades	29,860	0	---	0	---	0
*Littlewood River	976	0	---	0	---	0
*Jorden Valley	1,360	0	---	0	---	0
*Owyhee	2,427	0	---	0	---	0
**Preston Bench	132	0	---	0	---	0
**Bear River	2,082	0	---	0	---	0
Total	453,046	200	---	146,240	---	0

Contacts: F. M. Warnick, Chief, Regional Project Development Engineer; John H. Welch, Land Management Division, Boise, Idaho; L. M. Butterfield, Chief of Land Branch and Paul Schaffer, Chief of Land Resources of Salt Lake City, Utah. Data were developed from land classification records by land types I, II, III by the Bureau of Reclamation. *Lands administered from Boise office **Lands administered from Salt Lake City office.

Table 24-2.--Idaho: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Boise	5,224,000	0	---	75,000	50	1,800,000
Burley	1,250,000	80,000	45	15,000	50	72,000
Idaho Falls	2,098,000	2,000	25	50,000	50	100,000
Salmon	1,323,000	0	---	5,000	25	480,000
Shoshone	1,867,000	0	---	15,000	40	22,000
Coeur d'Alene	195,000	800	250	100	100	200
Total	11,957,000	82,800	---	160,100	---	2,474,200
Land Utilization and National Grassland	73,000	5,000	45	15,000	50	50,000

Contacts: Joe T. Fallini, State Director, and Orval G. Hadley, Manager, Land Office, BLM, Boise, Idaho. Data: (1) University of Idaho Soil Survey. (2) Bureau of Reclamation Soil Survey, (3) Judgement of district specialists.

Table 24-3.--Idaho: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Craters of the Moon	53,550	0	---	0	---	0
Nez Perce	80	20	300	20	400	20
Total	53,630	20	---	20	---	20

Contact: Merle E. Stitt, Acting Assistant Regional Director, Western Region, San Francisco, California. Data were developed as estimates by regional specialists of National Park Service.

Table 24-4.--Idaho: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Minidoka	1,320	0	---	0	---	0
Camas	10,656	0	---	1,500	200	0
Deer Flat	1,095	0	---	417	600	80
Kootenai	2,762	0	---	1,600	500	0
Grays Lake and Bear Lake	30,655	1,492	150	3,675	100	42
Other	4,025	0	---	0	---	0
Total	50,513	1,492	---	7,192	---	122

Contacts: John D. Findlay, Regional Director; William M. Lindsay, Regional Supervisor of Division of Realty; C. J. Lankford, Assistant Supervisor of Division of Wildlife Refuge, Portland, Oregon. Data supported by judgment of specialists, soil surveys, and cover typing in agency reports.

Table 24-5.--Idaho: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
*Boise	2,632,321	5	100	28	---	5,000
*Cache	264,141	0	---	0	---	100
*Carribou	963,952	200	---	58	---	500
*Challis	2,447,243	0	---	58	---	200
*Salmon	1,767,585	0	---	24	---	500
*Payette	2,307,158	62	---	40	---	1,000
*Sawtooth	1,731,526	0	---	0	---	400
*Targhee	1,319,532	0	---	11	---	600
*Curlew - L. U.	47,599	0	---	6	---	20,000
**Bitteroot	460,812	0	---	0	---	0
**Clearwater	1,675,562	0	---	0	---	0
**Coeur d'Alene	723,168	28	---	0	---	0
**Kanishu	891,939	24	---	0	---	0
**Kootenai	48,851	0	---	0	---	0
**Nezpeze	198,094	18	---	0	---	0
**St. Joe	862,027	1	---	0	---	0
Total	18,341,510	383	---	225	---	28,300
National Grassland and Land Utilization	47,599	0	---	6	---	20,000

Contacts: William H. Shaw, Chief, Branch of Land Use, Ogden, Utah; P. M. Yovetich, Forester; and E. F. Barry, Chief, Division of Recreation and Lands, Missoula, Montana. Data were provided by U. S. Forest Service personnel.
*National Forests administered from Intermountain Region, Ogden, Utah.
**National Forests administered from Northern Region, Missoula, Montana.

Table 24-6.--Idaho: Department of Defense-estimated acres and value of federal public lands suited for intensive agriuclture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	3,182	0	---	0	---	0
Air Force	115,586	0	---	0	---	0
Atomic Energy	572,267	0	---	0	---	120,000
Total	691,035	0	---	0	---	120,000
Corps of Civil Engineers	0	0	---	0	---	0

Contacts: Technical Program Staff, Soil Conservation Service, Boise, Idaho. Data are projected estimates based on the judgment of soil specialists as determined from soil surveys and land classification for adjacent areas.

Table 25-1.--Kansas: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Wichita	17,173	1,765	200	---	0	0
Total	17,173	1,765	200	---	0	0

Contacts: Leon Hill, Regional Director; O. J. Lowry, Chief of Land Management; George Loomis, Agriculture Economist, Amarillo, Texas. Data are based on soil conservation classification surveys and estimates by Bureau of Reclamation.

Table 25-2.--Kansas: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
All BLM Lands	1,511	0	---	0	---	0

These lands estimated as not suitable for agricultural production; however, no specific data are available.

Table 25-3.--Kansas: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Fort Larned	406	0	---	0	---	0
Fort Scott	750	150	150	0	---	210
Total	1,156	150	---	0	---	210

Contact: Fred Fagergren, Regional Director, Omaha, Nebraska. Data based on land use capability classification and estimates by specialists.

Table 25-4.--Kansas: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Flint Hills	18,500	0	---	0	---	0
Quivira	21,200	2,500	130	0	---	0
Total	39,700	2,500	130	0	---	0

Contacts: William J. Krummes, Regional Director; J. J. Harmon, Assistant Regional Supervisor and Division of Wildlife Refuge, Albuquerque, New Mexico. Data were based on (1) Soil Survey and Land Use Classification by Soil Conservation Service, (2) judgment by specialists, (3) field evaluation by refuge managers.

Table 25-5.--Kansas: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Cimarron --L. U. Lands	107,255	43,000	100	43,000	250	0
Total-- L. U. Land	107,255	43,000	---	43,000	---	0

Contacts: Earl Hendrickson, Assistant Regional Forester, Denver, Colorado; Technical Program Staff, Soil Conservation Service, Salina, Kansas. Data secured with assistance of Soil Conservation Service and based on knowledge of the area and on surveys of similar soils in adjacent areas.

Table 25-6.--Kansas: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	116,710	23,000	150	0	---	0
Air Force	45,164	4,500	150	0	---	0
Navy	1,934	100	150	0	---	0
Total	163,808	27,600	150	0	---	0
Corps of Civil Engineers	258,378	24,400	60	0	---	0

Contacts: Frederick R. Conner, Chief, Management and Disposal Branch, Omaha; Technical Program Staff, Soil Conservation Service, Salina, Kansas. Data are estimates obtained with assistance of Soil Conservation Service soil scientists, based on knowledge of the lands and projected from surveys of similar soils.

Table 26-1.--Montana: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Buffalo Rapids	81	0	---	0	---	0
Fort Peck	188	0	---	0	---	0
Hantley	973	0	---	0	---	0
Yellowstone Lower	4,084	0	---	0	---	0
Milk River	87,011	2,000	120	100	150	0
Canyon River	42,858	0	---	1,500	350	0
East Bench	10,061	0	---	0	---	0
Helena Valley	1,060	0	---	0	---	0
Lower Morias	62,636	10,000	100	2,000	300	0
Missouri Diversion	2,428	0	---	1,000	300	0
Moorhead	4,564	0	---	0	---	0
Three Forks Division	722	0	---	100	300	0
Yellowstone Unit	33,797	0	---	0	---	0
Sun River	41,958	0	---	500	300	0
Frenchtown	132	0	---	0	---	0
Hungry Horse	30,638	0	---	0	---	0
Total	323,191	12,000	---	5,200	---	0

Contacts: John Robertson, Head, Land Uses and Recreation Branch; D. Merlin Archibald, Natural Resource Specialist, Billings, Montana; John H. Welch, Land Management Division, Boise, Idaho, Bureau of Reclamation. Data were taken from Bureau of Reclamation file records on land classification types I, II, III lands.

Table 26-2.-- Montana: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Malta	1,825,951	18,000	40	0	---	0
L. Utilization	934,889	36,000	40	0	---	400
Miles City	2,238,342	15,000	40	0	---	5,000
L. Utilization	537,965	1,000	40	0	---	800
Billings	305,000	400	35	0	---	1,000
L. Utilization	73,400	0	---	0	---	200
Dillon	1,062,127	8,000	30	0	---	0
Lewiston	532,770	5,000	30	0	---	200
L. Utilization	354,383	4,000	35	0	---	400
Missoula	206,783	500	35	0	---	100
Total	8,071,610	87,900	---	0	---	8,900
Land Utilization	1,900,637	41,000	---	0	---	1,800

Contacts: E. L. Kemmis, Economist, Bureau of Land Management, Billings, Montana; Technical Program Staff, Soil Conservation Service, Bozeman, Montana; A. H. Post, Soils Department, Montana State University, Bozeman, Montana. Data are estimates provided through the assistance of Soil Conservation Service by projecting and comparing land ownership maps and soil surveys with the public domain areas.

Table 26-3.--Montana: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Glacier	1,013,129	0	---	0	---	1,000
Custer Battlefield	765	0	---	0	---	270
Bighorn	122,623	2,000	30	0	---	3,000
Bighole	525	0	---	0	---	0
Total	1,137,052	2,000	---	0	---	4,270

Contact: Robert L. Giles, Acting Regional Director, National Park Service, Omaha, Nebraska. Data are estimates based on Soil and Moisture Conservation Needs Inventory and related reports.

Table 26-4.--Montana: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Red Rock Lakes (acq.)	33,073	0	---	0	---	0
Ravilla	2,280	0	---	400	300	0
Benton Lake (acquired)	130	0	---	0	---	0
National Bison Range	18,542	600	300	0	---	0
Black Coulee	640	100	60	0	---	0
Creedman Coulee	80	0	---	0	---	0
Red Rock Lakes (dom.)	6,870	0	---	0	---	0
Medicine Lake	31,457	2,000	125	0	---	100
Benton Lake (domain)	12,235	4,560	150	0	---	0
Hewitt Lake	1,680	100	60	0	---	0
Lake Thibadeau	3,508	0	0	0	---	0
Chas. M. Russell	978,488	0	---	2,236	100	1,000
Total	1,088,983	7,360	---	2,636	---	1,100

Contacts: John D. Findlay, Regional Director; William M. Lindsay, Regional Supervisor of Division of Realty; C. J. Lankford, Assistant Supervisor of Division of Wildlife Refuge, Portland, Oregon. Data were developed from soil surveys and covertyping in agency reports and by judgment of specialists. No reports received for Hailstone, Halfbreed Lake, Mason Lake, Lamesteer, and War Horse.

Table 26-5.--Montana: U.S. Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Beaver Head	2,111,058	5,000	70	0	---	0
Bitterroot	1,115,147	10,000	80	0	---	0
Custer	1,112,175	110,000	80	0	---	0
Deer Lodge	1,181,276	0	---	0	---	0
Flathead	2,341,832	5,000	70	0	---	0
Gallatin	1,699,548	0	---	0	---	0
Helena	969,004	10,000	70	0	---	0
Kaniksu	446,966	0	---	0	---	0
Kootena	1,770,926	10,000	70	0	---	0
Lewis & Clark	1,834,652	10,000	70	0	---	0
Lolo	2,086,357	5,000	70	0	---	0
Miscellaneous	158	0	---	0	---	0
Total	16,669,099	165,000	---	0	---	0

Contacts: P. M. Yovetich, Forester, Section Land Status, Missoula, Montana; Technical Program Staff, Soil Conservation Service, Bozeman, Montana; A. H. Post, Soils Department, Montana State University, Bozeman. Data were developed as estimates, through assistance of Soil Conservation Service personnel, by projecting and comparing land ownership to classified soils.

Table 26-6.--Montana: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	6,659	0	---	0	---	0
Air Force	5,934	0	---	0	---	0
Total	12,593	0	---	0	---	C
Corps of Civil Engineers	558,609	5,000	70	0	---	0

Data are estimates made by comparing ownership maps and projecting the acreages from areas of similar soils and topography.

Table 27-1.--Nebraska: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Combined Projects	66,907	600	---	1,000	---	0

Contact: Henry J. Hoff, Chief, Land Resource and Soil Laboratory, Denver, Colorado. Data were estimated based on maps and general knowledge of areas.

Table 27-2.-- Nebraska: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agruculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
All BLM Lands	7,948	100	---	0	---	600

Contacts: E. Pierson, State Director; O. J. Simpson, Chief, Division Lands and Minerals Program Management, and Phillip Hamilton, Economist Planner, Cheyenne, Wyoming. Data are estimated acreages based on general knowledge of area and soils in adjacent areas.

Table 27-3.--Nebraska: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Agate Fossil Beds	2,800	200	---	0	---	200
Scotts Bluff	3,084	350	---	0	---	300
Homestead	163	0	---	0	---	100
Total	4,321	550	---	0	---	600

Contact: Robert L. Giles, Acting Regional Director, Omaha, Nebraska. Data are estimated acreages obtained from Midwest National Park Service Report of November, 1968.

Table 27-4.--Nebraska: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Valentine	71,516	0	---	0	---	0
Hastings	9,468	4,595	350	2,200	500	0
Ft. Niobrara	19,122	54	80	0	---	0
Cresent Lake	45,996	0	---	0	---	0
Total	74,586	4,649	---	2,200	---	0

Contact: Lewis R. Garlick, Acting Regional Director, Minneapolis, Minnesota. Data were developed by refuge managers supported by soil surveys from Soil Conservation Service, judgment of specialists, and county extension agent. Data not provided for DeSoto and North Platte.

Table 27-5.--Nebraska: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
C. P. F. O.	245,414	0	---	0	---	0
Oglala - Land Utilization	103,985	0	---	0	---	20,000
Total	349,399	0	---	0	---	20,000

Contact: Earl Hendrickson, Assistant Regional Forester, Denver, Colorado. Data were developed by Forest Service personnel of Denver office.

Table 27-6.--Nebraska: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	33,643	1,200	---	600	---	1,700
Navy	37,870	2,500	---	1,100	---	3,500
Air Force	7,710	0	---	0	---	0
Total	79,223	3,700	---	1,700	---	5,200
Corps of Civil Engineers	54,036	0	---	0	---	0

Contact: Frederick R. Conner, Chief, Management and Disposal Branch, Corps of Engineers, Omaha, Nebraska. Data were developed from general information on area by using maps and soil surveys of comparable areas to project estimated acreages.

Table 28-1.--Nevada: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
*Washoe	8,713	0	---	0	---	400 - $250
*Newlands	468,145	0	---	0	---	75,000 - $250
*Humboldt	82,269	0	---	0	---	3,000 - $300
Administered from Boulder City	611,600	0	---	2,500	500	2,100
Total	1,171,027	0	---	2,500	500	80,500

Contacts: W. E. Jaggert, Chief, Land Management Division; Franch Pecarich, Assistant Land Management Division, Bureau of Reclamation, Sacramento, California; W. L. Phillips, Acting Regional Director, Boulder City, Nevada. Data are taken from records of Bureau of Reclamation for land classes type I, II, III having suitability for irrigation.
*Projects administered from Bureau of Reclamation office of Sacramento, California.

Table 28-2.--Nevada: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Elko	7,395,538	0	---	0	---	1,479,107
Winnemucca	7,626,620	0	---	0	---	1,523,324
Carson City	5,136,345	0	---	0	---	1,027,269
Ely	8,036,464	0	---	0	---	1,607,292
Las Vegas	9,887,310	0	---	0	---	1,977,462
Battle Mountain	8,501,544	0	---	0	---	1,700,308
Susanville	1,431,976	0	---	0	---	286,395
Boise	51,288	0	---	0	---	10,257
Total	48,067,085	0	---	0	---	9,613,414
Land Utilization	3,287	0	---	0	---	600

Contacts: Nolan F. Keil, State Director; M. Buzan, Chief, Division of Resource Management; Rolla Chandler, Chief of Lands and Minerals, BLM, Reno, Nevada. Data taken from reports of Planning Subcommittee, Pacific Southwest Inter-Agency Committee but are subject to change upon completion of studies under Type I River Basin Framework studies for the lower Colorado River and Great Basin Regions.
Note: 4,806,207 acres valued at $25 per acre, 2,403,353 acres at $15, and remainder at $10 per acre undeveloped.

Table 28-3.--Nevada: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Death Valley	115,240	0	---	0	---	0
Lehman Caves	640	0	---	0	---	0
Lake Mead	692,327	0	---	0	---	50,000
Total	808,207	0	---	0	---	50,000

Contacts: Monte E. Fitch, Acting Regional Director, Santa Fe, New Mexico; Merle E. Stitt, Acting Regional Director, San Francisco, California
Source of data are estimates made by specialists and staff members of National Park Service.

Table 28-4.--Nevada: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Ruby Lake	37,191	80	30	340	90	2,600
Desert N. W. R. & Pahranagat	1,593,409	0	---	314	135	200
Sheldon-Hart Mtn.	54,909	0	---	0	---	0
Railroad Valley	14,720					
Total	1,700,329	80	---	654	---	2,800

Contacts: John D. Findlay, Regional Director; William M. Lindsay, Regional Supervisor of Division of Realty; C. J. Lankford, Assistant Supervisor of Division of Wildlife Refuge, Portland, Oregon. Data were developed by specialists of Bureau of Sport Fisheries and Wildlife.

Table 28-5.--Nevada: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Humboldt	2,512,258	0	---	15	---	2,000
Toiyable	2,490,057	0	---	0	---	2,000
Eldorado	40	0	---	0	---	0
Inyo	60,576	0	---	0	---	0
Total	5,062,930	0	---	15		4,000

Contacts: William H. Shaw, Branch Chief, Land Uses, Ogden, Utah; Joseph V. Flynn, Assistant Regional Director, San Francisco, California. Data were developed as estimates by personnel of U. S. Forest Service.

Table 28-6.--Nevada; Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Atomic Energy	795,911	0	---	0	---	30,000
Air Force	2,929,156	0	---	0	---	120,000
Navy	212,054	0	---	3,725	300	15,000
Army	7,167	0	---	0	---	0
Total	3,944,293	0	---	3,725	---	165,000
Corps of Civil Engineers	1,020	0	---	0	---	0

Contacts: Technical Program Staff, Soil Conservation Service, Reno, Nevada. Data were developed, with assistance of Soil Conservation Service, as projected estimates from existing surveys of similar soils in adjacent areas.

Table 29-1.--New Mexico: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Animes La Plata	1,159	0	---	0	---	0
Hammond	158	0	---	0	---	0
Navajo	33,132	0	---	0	---	0
Transmission	501	0	---	0	---	0
Carlsbad)						
Reo Grande)						
Vermejo)	All projects					
Middle Reo Grande)	160,892	0	---	0	---	5,000
Hondo)						
Fort Sumner)						
Total	197,842	0	---	0	---	0

Contacts: L. M. Butterfield, Chief, Land Resource, Salt Lake City, Utah; O. J. Lowry, Chief of Land Management, Amarillo, Texas. Data were developed from file records of Bureau of Reclamation on land classification.

Table 29-2.--New Mexico: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Albuquerque	2,874,480	0	---	0	---	646,585
Socorro	1,654,069	0	---	0	---	100,000
Las Cruces	5,543,062	0	---	0	---	500,000
Roswell	3,611,297	0	---	0	---	486,616
Total	13,682,908	0	---	0	---	1,733,201
Land Utilization						
Albuquerque	216,258	0	---	0	---	21,625
Las Cruces	3,822	0	---	0	---	0
Roswell	4,768	0	---	0	---	2,384
Total L. U.	224,848	0	---	0	---	24,009

Contacts: H. A. Berends, Chief, Land Acquisition and Exchange; Peter A. Gutierrez, Supervisor of Land Examiners, Santa Fe, New Mexico; Technical Program Staff, Soil Conservation Service, Albuquerque, New Mexico. Data are supported by soil surveys, River Basin studies, watershed specialists and provided by BLM and Soil Conservation Service.

Table 29-3.--New Mexico: National Park Service-estimated acres and value of federal public lands suitable for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Bandelier	29,661	0	---	0	---	0
Capulin Mountain	720	0	---	0	---	0
Carlsbad Caverns	46,433	0	---	80	---	5,000
Chaco Canyon	20,989	0	---	0	---	8,000
Fort Union	721	0	---	0	---	721
Gila Cliff	533	0	---	0	---	0
Pecos	341	0	---	0	---	200
White Sands	140,247	0	---	0	---	0
Total	239,645	0	---	0	---	13,921

Contact: Monte E. Fitch, Acting Assistant Regional Director, Operations, Santa Fe, New Mexico. Data based on multiple judgment of Resource Management personnel of National Park Service.

Table 29-4.--New Mexico: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Bitter Lake	23,149	203	150	0	---	0
Bosque Del Apache	57,191	0	---	4,139	550	420
Las Vegas	6,593	0	---	2,000	150	2,000
Maxwell	2,687	0	---	915	200	0
San Andres	57,215	0	---	0	---	0
Total	146,835	203	---	7,054	---	2,420

Contact: William T. Krummes, Regional Director, Albuquerque, New Mexico. Data were developed by personnel of Sport Fisheries and Wildlife and based on field evaluations of areas under study.

Table 29-5.--New Mexico: U.S. Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Apache	616,160	0	---	41	500	8,000
Carson	1,422,402	0	---	36	500	0
Cibola	1,584,577	0	---	67	400	11,000
Gila	2,701,614	0	---	176	500	46,000
Lincoln	1,086,379	0	---	33	700	0
Santa Fe	1,441,569	0	---	36	400	0
Kiowa (National Grassland)	136,505	0	---	4,000	100	2,000
Total	8,922,268	0	---	4,389	---	67,000

Contact John T. Koen, Assistant Regional Forester; Allan G. Watkins, Head, Branch of Land Acquisition and Exchange; E. H. Taylor, Head, Division of Lands and Minerals, Albuquerque, New Mexico. Data developed by Forest Service personnel from soil surveys using standard criteria for appraising land classes.

Table 29-6.--New Mexico: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	2,724,976	0	---	0	---	573,800
Atomic Energy	72,105	0	---	0	---	3,600
Air Force	100,407	0	---	0	---	20,000
Total	2,897,488	0	---	0	---	597,400
Corps of Civil Engineers	13,326	0	---	0	---	2,600

Contact: Soil Conservation Service, Technical Program Staff personnel of Albuquerque. Data are estimates obtained with assistance of Soil Conservation Service and based on unpublished "State General Soil Association Map for New Mexico" prepared by Soil Conservation Service and New Mexico Agricultural Experiment Station.

Table 30-1.--North Dakota: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Lower Yellowstone	210	0	---	0	---	0
Dickinson	22,057	0	---	0	---	0
Garrison Diversion	5,319	0	---	0	---	0
Heart Butte	10,776	0	---	0	---	0
Transmission	344	0	---	0	---	0
Total	38,706					

Contacts: John Robertson, Head, Land Uses and Recreation; D. Merlin Archibald, Natural Resource specialist, Billings, Montana. Data were taken from Bureau of Reclamation file records on Land Classification for type I, II, III land.

Table 30-2.--North Dakota: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
All BLM Lands in North Dakota	75,785	3,800	50	0	---	0

Contacts: E. L. Kemmis, Economist, Bureau of Land Management, Billings, Montana; Technical Program Staff, Soil Conservation Service, Bozeman, Montana. Data are estimates provided through the assistance of Soil Conservation Service personnel by projecting and comparing land ownership maps and soil surveys with these public lands.

Table 30-3.--North Dakota: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
The Roosevelt National Memorial Park	69,000	5,760	---	0	---	0

Contacts: Robert L. Giles, Acting Regional Director, National Park Service, Omaha, Nebraska; Technical Program Staff, Soil Conservation Service, Bismarck, North Dakota. Data are estimates based on soil surveys of Billings County, North Dakota.

Table 30-4.--North Dakota: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
J. Clark Salyer	59,699	3,000	100	300	75	0
Tewaukon	17,142	6,311	100	250	175	200
Crosby	16,080	2,326	125	0	---	200
Sully Hills	1,714	320	80	0	---	0
Upper Souris	32,290	1,637	125-300	637	300	0
Devils Lake	18,641	8,390	80	0	---	0
Audubon	16,740	4,500	100	500	---	100
Lostwood	30,643	333	60-100	0	---	0
Slade	3,000	0	---	600	60	0
Long Lake	12,600	2,500	---	0	---	0
Waterfowl Prod.	12,000	669	70	450	---	0
Arrowwood	44,236	7,789	155	1,675	275	3,200
Total	283,666	39,135	---	4,412	---	3,700

Contact: Lewis R. Garlick, Acting Regional Director, Minneapolis, Minnesota. Data were developed from Soil Conservation Service land classification soil surveys and Land Use Planning by County Extension, Soil Conservation Service, and Sport Fisheries and Wildlife personnel.

Table 30-5.--North Dakota: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Grasslands	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Little Missouri	1,026,612	123,640	---	0	---	0
Cedar River	6,717	3,300	---	0	---	0
Souris	520	40	---	0	---	0
Cheyenne	71,109	27,000	---	0	---	0
Total	1,104,958	183,680	---	0	---	0

Contacts: P. M. Yovetich, Forester Head, Section Land Status, Missoula, Montana; Technical Program Staff, Soil Conservation Service, Bismarck, North Dakota. Data were developed with assistance of Soil Conservation Service as estimates projected from soil survey maps and other related data of Billings County and other similar areas.

Table 30-6.--North Dakota: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	123	40	---	0	---	0
Air Force	12,051	10,750	---	0	---	0
Total	10,790	10,790	---	0	---	0
Corps of Civil Engineers	54,987	18,500	---	0	---	0

Contacts: Technical Program Staff, Soil Conservation Service, Bismarck, North Dakota. Data were developed with assistance of soil scientist, Soil Conservation Service, and projected as estimates based on conservation-needs sampled areas in the adjacent areas.

Table 31-1.--Oklahoma: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Washita	All	0	---	0	---	0
Fort Cobb	combined	210	200	0	---	0
Foss	project	95	200	0	---	0
W. C. Austin		20	150	0	---	35
Norman		0	---	0	---	0
Arbuckle		0	---	0	---	0
Total	73,158	325	---	0	---	35

Contacts: Leon Hill, Regional Director; O. J. Lowry, Chief of Land Management; George Loomis, Agricultural Economist, Amarillo, Texas. Data were developed from records of Bureau of Reclamation and based on National Soil Classification surveys.

Table 31-2.--Oklahoma: Bureau of Land Mangaement-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
All Lands Combined	17,868	1,000	---	0	---	2,000
Total	17,868	1,000	---	0	---	2,000

Contacts: H. A. Berends, Chief, Branch of Land Acquisition and Exchange, Santa Fe, New Mexico; Technical Program Staff, Soil Conservation Service, Albuquerque, New Mexico. Data are estimates obtained by projecting acreages from similar soils in the area.

Table 31-3.--Oklahoma: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Platt	912	500	110	0	---	0
Arbuckle	5,646	0	---	0	---	1,100
Total	6,558	500	---	0	---	1,100

Contacts: Monte E. Fitch, Acting Assistant Regional Director, Santa Fe, New Mexico. Data were developed as estimates made by Resource Management personnel of National Park Service, Santa Fe, New Mexico.

Table 31-4.--Oklahoma: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Salt Plains	32,000	852	190	0	---	291
Tishomingo	16,609	800	350	330	400	0
Wachita	8,200	2,585	225	155	500	2,585
Washita Mts.	59,020	0	---	0	---	0
Total	115,829	4,237	---	485	---	2,876

Contacts: William T. Krummes, Regional Director, Albuquerque, New Mexico. Data were developed by personnel of Sport Fisheries and Wildlife and based on judgment of specialist, soil surveys and field evaluation of refuge managers.

Table 31-5.--Oklahoma: U.S. Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Black Kettle	31,199	0	---	0	---	0
Rita Blanca	15,639	0	---	3,000	150	1,500
Total	46,838	0	---	3,000	---	1,500

Contacts: John J. Koen, Assistant Regional Director; Allan G. Watkins, Head, Branch of Land Acquisition and Exchange; E. H. Taylor, Head, Division of Lands and Minerals, Albuquerque, New Mexico. Data were compiled by Forest Service personnel from soil surveys using standard criteria for appraising land classes.

Table 31-6.--Oklahoma: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	127,826	20,000	---	0	---	18,280
Navy	44,965	14,000	---	0	---	14,885
Air Force	9,897	2,500	---	0	---	3,215
Total	182,688	36,500	---	0	---	36,380
Corps of Civil Engineers	711,899	1,000	---	0	---	2,000

Contacts: Frederick R. Conner, Chief, Management and Disposal Branch, Corps of Engineers, Omaha, Nebraska; Technical Program Staff, Soil Conservation Service, Stillwater, Oklahoma. Data are estimates developed with assistance of Soil Conservation Service based on existing soil surveys.

Table 32-1.--Oregon: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Umatilla	20,689	0	---	11,000	350	0
Owyhee	37,279	0	---	0	---	0
Deschutes	30,369	0	---	0	---	0
Crooked River	8,831	0	---	0	---	0
Baker	6,022	0	---	0	---	0
John Day	7,514	0	---	0	---	0
Vale	11,809	0	---	0	---	0
Burnt River	1,536	0	---	0	---	0
Wapinitia	1,930	0	---	0	---	0
Roque River Basin	8,498	0	---	0	---	0
Melford and Sams Valley	760	0	---	0	---	0
Cresent Lake	1,984	0	---	0	---	0
Klamath	100,353	535	100	5,940	300	11,500 - $250
Total	147,573	535	100	22,540	---	11,500 - $250

Contacts: F. M. Warnick, Chief, Regional Project Development Engineer; John H. Welch, Land Management Division, Boise, Idaho; Technical Program Staff, Soil Conservation Service, Boise, Idaho. Data were developed from land classification records for type I, II, III lands and the Columbia-North Pacific studies.

Table 32-2.--Oregon: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
All districts of Oregon	13,573,038	59,100	---	0	---	537,600

Contacts: Irving W. Anderson, Chief, Land and Minerals Program Management and Land Office; Leo M. Simmons, Realty Specialist, Portland, Oregon; Donel Lane, Director, Water Resource Commission, Salem, Oregon; Soil Conservation Service Technical Staff, Portland, Oregon. Data were developed from Columbia River-North Pacific comprehensive studies with assistance of Soil Conservation Service personnel of Portland.

Table 32-3.--Oregon: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Crater Lake	160,290	0	---	0	---	0
Fort Clatsop	120	10	---	0	---	0
Oregon Caves	480	0	---	0	---	0
Total	160,890	10	---	0	---	0

Contact: Merle E. Stitt, Acting Assistant Regional Director, San Francisco, California. Data are estimates developed by regional specialists of National Park Service.

Table 32-4.--Oregon: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Sheldon-Hart Mts.	238,209	0	---	0	---	0
Wm. L. Finley	4,329	2,257	300	20	450	835
Ankeny	1,543	1,050	250	75	300	418
Basket Slough	2,493	1,380	400	394	500	498
Cape Meares	139	0	---	0	---	0
Oregon Islands	384	0	---	0	---	0
Umatilla	2,016	0	---	314	525	0
Malheur	180,794	0	---	48,678	150	12,200
Klamath Basin *	96,613	0	---	0	---	0
McNary	451	100	700	0	---	150
Deer Flat	159	0	---	30	200	0
Other	7,168	50	200	0	---	0
Total	534,298	4,837	---	49,511	---	14,101

Contacts: William M. Lindsay, Regional Supervisor of Division of Realty; C. J. Lankford, Assistant Supervisor of Division of Wildlife Refuge, Portland, Oregon. Data were developed from soil surveys and projected judgment of Sport Fisheries and Wildlife specialists.
*A group of refuges -- some in California

Table 32-5.--Oregon: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Combined National Forests for Oregon	15,039,602	2,660	75	0	---	62,100 - $400
Total	15,039,602	2,660	---	0	---	62,100

Contacts: John H. Brillhart, Branch Chief, Land Adjustment Classification Status; J. D. Walker, Forester, Land Adjustment Classification Status, Portland, Oregon; Technical Program Staff, Soil Conservation Service, Portland, Oregon. Data were developed with assistance of Soil Conservation Service technicians and were based on Columbia-North Pacific Comprehensive and River Basin Studies.

Table 32-6.--Oregon: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
All Defense agencies	48,100	0	---	0	---	0
Total	48,100	0	---	0	---	0

Contact: Technical Program Staff, Soil Conservation Service, Portland, Oregon. Data were based on Columbia-North Pacific studies and indicate no acreage suitable for agricultural production.

Table 33-1.--South Dakota: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Belle Fourche	16,056	0	---	0	---	0
Angostura	9,261	0	---	0	---	0
Oahe	523	0	---	0	---	0
Rapid Valley Pactola	3,948	0	---	0	---	0
Shadehill	13,158	0	---	0	---	0
Rapid Valley	2,259	0	---	0	---	0
Transmission	564	0	---	0	---	0
Total	45,769	0	---	0	---	0

Contacts: John Robertson, Head, Land Use and Recreation Branch; D. Merlin Archibald, Natural Resource Specialist, Billings, Montana. Data were taken from Bureau of Reclamation file records on land classification.

Table 33-2.--South Dakota: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
All BLM Lands in South Dakota	277,900	30,000	50	0	---	3,000

Contacts: E. L. Kemmis, Economist, Bureau of Land Management, Billings, Montana; Technical Program Staff, Soil Conservation Service, Huron, South Dakota. Data were developed, with assistance of Soil Conservation Service personnel, as estimates by projecting the acreages from soil surveys of similar areas.

Table 33-3.--South Dakota: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Mt. Rushmore	1,278	0	---	0	---	0
Badlands	111,530	0	---	0	---	1,000
Wind Cave	28,059	1,000	50	0	---	4,000 - $300
Jewel Cave	1,274	0	---	0	---	0
Total	142,141	1,000	---	0	---	5,000

Contact: Robert L. Giles, Acting Regional Director, Midwest Region, Omaha, Nebraska. Data were developed as estimates from Midwest Region reports, maps, and related references.

Table 33-4.--South Dakota: Bureau of Sport Fisheries and Wildlife-estimated acres of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Waubay	14,320	2,635	90	300	200	500
Lake Andes	11,345	2,200	100	0	---	1,650
Sand Lake	5,373	280	70	280	---	0
Sand Lake	21,451	3,068	165	50	---	3,018
LaCreek	9,825	546	135	546	150	0
Total	62,404	8,729	---	1,176	---	5,168

Contact: Lewis R. Garlick, Acting Regional Director, Minneapolis, Minnesota. Data were developed as estimates based on judgment of specialists and national soil surveys provided by Soil Conservation Service.

Table 33-5.--South Dakota: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Custer	73,489	0	---	0	---	0
Black Hills	1,048,968	0	---	0	---	0
Buffalo Gap L. U. Lands	585,372	101,000	---	45,000	---	45,000
Fort Pierre L. U. Lands	115,893	23,000	---	0	---	5,000
Grand River L. U. Lands	155,426	62,000	---	0	---	30,000
Total	1,979,148	186,000	---	45,000	---	80,000
L. U. Lands	856,691	186,000	---	45,000	---	80,000

Contacts: Earl Hendrickson, Assistant Regional Forester, Denver, Colorado; Technical Program Staff, Soil Conservation Service, Huron, South Dakota. Data were developed as estimates, with assistance of Soil Conservation Service personnel, by projecting acreages from Conservation Needs Inventory sampled areas and soil surveys of similar areas.

Table 33-6.--South Dakota: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	21,417	335	---	0	---	200
Air Force	247,027	9,500	---	0	---	2,500
Total	268,444	9,835	---	0	---	2,700
Corps of Civil Engineers	518,786	1,000	---	0	---	1,000

Contacts: Frederick R. Conner, Chief, Management and Disposal Branch, Omaha, Nebraska; Technical Program Staff, Soil Conservation Service, Huron, South Dakota. Data were developed, with assistance of Soil Conservation Service personnel, as estimates by projecting acreages from soil surveys in adjacent areas of comparable soils.

Table 34-1.--Texas: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
San Angelo and Canadian River	61,504	0	---	0	---	0
Total	61,504	0	---	0	---	0

Contacts: Leon Hill, Regional Director; O. J. Lowry, Chief of Land Management, Bureau of Reclamation, Amarillo, Texas. Data furnished by Bureau of Reclamation and based upon file records on land classification.

Note: Table 34-2 is missing since there are no Bureau of Land Management acreages in Texas.

Table 34-3.--Texas: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Alibates	500	0	---	0	---	100
Amistad	43,559	0	---	0	---	8,000
Big Bend	706,538	0	---	0	---	112,000
Fort Davis	447	0	---	0	---	447
Quadalupe	19,640	0	---	0	---	0
Padre Island	133,840	0	---	0	---	0
Sanford	41,097	0	---	0	---	15,000
Total	945,621	0	---	0	---	135,547

Contacts: Monte E. Fitch, Acting Assistant Regional Director, Operation, Santa Fe, New Mexico; Technical Program Staff, Soil Conservation Service, Temple, Texas. Data were developed as estimates by specialists of National Park Service, Santa Fe, New Mexico.

Table 34-4.--Texas: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Anahuac	9,833	60	225	1,060	250	0
Aransas	54,423	300	330	0	---	0
Brazoria	6,398	100	150	100	250	0
Buffalo Lake	7,677	3,060	135	45	400	0
Hagerman	11,429	1,210	275	0	---	205
Muleshoe	5,809	110	200	0	---	110
Laguna Atascosa	45,050	1,500	150	0	---	1,400
Santa Ana	1,980	100	200	0	---	0
Total	142,603	6,440	---	1,205	---	1,715

Contact: William T. Krummes, Regional Director, Albuquerque, New Mexico. Data were developed by personnel of Sport Fisheries and Wildlife and were based on national soil surveys, judgment of specialists and field evaluations by refuge managers.

Table 34-5.--Texas: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
L.U. lands/ National Grasslands	117,269	1,200	125	5,000	150	4,000
All lands by Forest Service						
Total	117,269	1,200	125	5,000	150	4,000

Contact: John T. Koen, Assistant Regional Forester, Albuquerque, New Mexico. Data are estimates provided by U.S. Forest Service and are based on soil surveys using national criteria for appraising lands suitable for irrigation.

Table 34-6.--Texas: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	372,859	55,000	75-200	0	---	37,280 - $150-300
Air Force	74,000	18,500	100-300	0	---	11,000 - $150-400
Navy	11,476	7,000	400-500	0	---	0
Total	458,335	80,500	---	0	---	48,280
Corps of Civil Engineers	613,406	61,000	75-200	0	---	0

Data were developed as estimates based upon Conservation Needs Inventory and projected from surveys of similar areas.

Table 35-1.--Utah: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Projects administered from Salt Lake City	1,608,713	0	---	0	---	0
Projects administered from Boulder City	62,400	0	---	1,100	450	500 - $450
Total	1,671,113	0	---	1,100	450	500 - $450

Contacts: L. M. Butterfield, Chief of Land Branch; Paul Schaffer, Chief of Land Resources, Salt Lake City, Utah; W. A. Phillips, Acting Regional Director, Boulder City, Nevada. Data were developed by contacting personnel of the Bureau of Reclamation and are taken from record files on land classification.

Table 35-2.--Utah: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Salt Lake	4,206,365	0	---	0	---	875,000
Vernal	1,600,936	0	---	0	---	110,000
Fillmore	4,825,984	0	---	0	---	959,000
Price	3,007,196	0	---	0	---	101,000
Cedar City	1,585,065	0	---	0	---	99,000
Richfield	1,850,915	0	---	0	---	41,000
Kanab	2,441,397	0	---	0	---	48,000
Monticello	3,476,611	0	---	0	---	182,000
Total	22,994,469	0	---	0	---	2,415,000
L. U. Lands						
Salt Lake	640	0	---	0	---	520
Fillmore	18,326	0	---	0	---	9,120
Total	18,966	0	---	0	---	9,640

Contacts: Robert M. Nielson, Regional Economist; Dennis Curtis, Economist, Bureau of Land Management, Salt Lake City, Utah. Arable land estimate is from reconnaisance survey by an interagency committee of soil scientists for the publication, Arable Land Resources of Utah, by the Utah Agricultural Experiment Station. The committee's work map was used to superimpose their findings on maps showing BLM administered lands.

Table 35-3.--Utah: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Arches	34,010	0	---	0	---	0
Aztec	27	27	30	0	---	15
Bryce Canyon	36,008	0	---	0	---	5,500
Canyonlands	257,640	0	---	0	---	12,000
Capitol Reed	37,906	500	25	0	---	3,000
Cedar Breaks	6,155	0	---	0	---	0
Glen Canyon	100,000	0	---	0	---	0
Golden Spike	1,562	0	---	0	---	1,100
Natural Bridges	7,126	0	---	0	---	0
Pipe Springs	40	0	---	0	---	25
Rainbow Bridge	160	0	---	0	---	0
Timpanogos Cave	250	0	---	0	---	0
Zion	139,550	0	---	0	---	6,000
Total	620,438	527	---	0	---	27,640

Contact: Monte E. Fitch, Acting Assistant Regional Director, Santa Fe, New Mexico. Data were developed by Resource Management personnel of National Park Service, Santa Fe, New Mexico.

Table 35-4.--Utah: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Bear River	64,895	0	---	0	---	0
Fish Springs	17,992	0	---	0	---	0
Ouray	7,700	0	---	2,500	250	300
Total	90,587	0	---	2,500	250	300

Contact: William T. Krummes, Regional Director, Albuquerque, New Mexico. Data were developed as estimates and represent multiple judgment of specialists in Soil Conservation Service, Agriculture Stabilization and Conservation Service, and Farm Home Administration.

Table 35-5.--Utah: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Ashley	1,271,146	20	---	7	---	100
Cache	408,894	22	---	0	---	0
Caribou	6,674	0	---	0	---	0
Dixie	1,883,688	15	---	14	---	400
Fish Lake	1,424,538	0	---	0	---	2,000
Manti-Lasol	1,236,368	150	---	0	---	200
Sawtooth	71,638	0	---	0	---	0
Unita	794,686	0	---	0	---	100
Wasatch	840,041	0	---	0	---	200
Totals	7,937,673	107	---	21	---	3,000

Contact: William H. Shaw, Branch Chief, Land Uses, Ogden, Utah. Data are estimates and were developed by Forest Service personnel at Ogden.

Table 35-6.--Utah: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	870,990	0	---	0	---	106,000
Air Force	937,603	0	---	10,000	---	0
Atomic Energy Com.	3,440	0	---	0	---	400
Navy	91,474	0	---	0	---	4,500
Total	1,903,507	0	---	10,000	---	110,900

Contact: Technical Program Staff, Soil Conservation Service, Salt Lake City, Utah. Data are estimates developed with assistance of Soil Conservation Service personnel and based on Conservation Needs Inventory Resource Bulletin No. 42, soil surveys, and comparison with comparable areas.

Table 36-1.--Washington: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Okanogan	2,818	0	---	0	---	0
Yakima	31,196	0	---	2,800	475	0
Columbia Basin	411,990	1,337	225	100,000	450	0
General Investigation	210	0	---	0	---	0
Chief Joseph Dam	288	0	---	0	---	0
Total	446,502	1,337	---	102,800	---	0

Contacts: H. T. Nelson, Regional Director; F. M. Warnick, Chief, Regional Project Development Engineer; John W. Welch, Land Management Division, Boise, Idaho. Data were developed by Bureau of Reclamation, Boise, Idaho, from file records of land classification of type I, II, and III lands.

Table 36-2.--Washington: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
All lands administered by BLM from Portland, Oregon	273,647	0	---	0	---	25,000
Total	273,647	0	---	0	---	25,000

Contacts: Irving W. Anderson, Chief, Land Minerals Program Management and Land Office; Leo Simms, Realty Specialist, Bureau of Land Management, Portland, Oregon; Technical Program Staff, Soil Conservation Service, Spokane, Washington, and Portland, Oregon; W. A. Starr, Professor of Soils, Washington State University, Pullman, Washington. Data are estimates and were developed from general reports on Columbia-North Pacific and River Basin studies with assistance of Soil Conservation Service personnel.

Table 36-3.--Washington: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Coulee Dam	98,500	4,000	---	1,000	300	3,000 - $300
Ft. Vancouver	90	10	400	10	700	10 - $700
Mt. Rainier	241,780	0	---	0	---	0
Olympic	888,930	2,000	400	2,000	700	2,000 - $700
San Juan Island	120	100	300	10	400	20 - $400
Whitman Mission	100	40	300	40	400	40 - $400
Total	1,222,950	6,150	---	3,060	---	5,070

Contact: Merle E. Stitt, Acting Assistant Regional Director, San Francisco, Calif. Data are estimates developed by multiple judgment of specialists in the National Park Service.

Table 36-4.--Washington: Bureau of Sport Fisheries and Wildlife-estimated acres of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
NcNary	168	0	---	0	---	0
Columbia	28,506	0	---	700	800	0
Ridgefield	2,483	1,120	750	600	900	500
Willapa	9,554	600	800	0	---	0
Turnbull	14,535	0	---	0	---	0
Conboy Lake and Toppenish	6,800	540	200	755	525	300
Umatilla	1,631	0	---	1,315	525	0
Dungeness	45	0	---	0	---	0
Copalis	5	0	---	0	---	0
Quillayute Needles	81	0	---	0	---	0
Flattery Rocks	125	0	---	0	---	0
Jones Island	188	0	---	0	---	0
Matia Island	145	0	---	0	---	0
Fed Aids	17,732	0	---	0	---	0
Total	82,111	2,260	---	3,370	---	800

Contacts: William M. Lindsay, Regional Supervisor, Division of Realty; C. J. Lankford, Assistant Supervisor, Division of Wildlife Refuges, Portland, Oregon. Data were developed by multiple judgment of specialists basing their estimates on soil surveys and cover typing agency reports.

Table 36-5.--Washington: U.S.Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
*Colville	943,517	22	---	0	---	0
*Kaniksu	282,743	7	---	0	---	0
Gifford Pinshot	1,267,340	0	---	0	---	0
Mt. Baker	1,818,348	0	---	0	---	0
Okanogan	1,520,448	10	---	0	---	0
Olympic	621,756	1	---	0	---	0
Shoqualmie	1,208,540	7	---	0	---	0
Wenatchee	1,733,413	20	---	0	---	0
Umatilla	313,738	70	---	0	---	0
Total	10,937,553	137	---	0	---	0
L. U. Lands						
Colville	485	0	---	0	---	0
Kanishu	240	0	---	0	---	0
Total	725	0	---	0	---	0

Contacts: P. V. Yovetich, Forester, U. S. Forest Service, Missoula, Montana; J. H. Brillhart, Branch Land Adjustment Classification Status, Portland, Oregon. Data submitted by U. S. Forest Service personnel.
*Forestry lands administered from Missoula, Montana, office--all others from Portland, Oregon, office.

Table 36-6.--Washington: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	351,292	2,000	---	0	---	0
Air Force	20,202	0	---	0	---	0
Navy	27,035	1,000	---	0	---	1,000
Atomic Energy Com.	358,000	0	---	48,000	---	10,000
Total	756,529	3,000	---	48,000	---	11,000
Corps of Civil Engineers	91,996	2,000	---	1,000	---	0

Contacts: N. G. Fuller, Chief, Property Branch, Atomic Energy Commission, Richland Washington; Technical Program Staff, Soil Conservation Service, Spokane, Washington. Data were developed as estimates with assistance of Atomic Energy Commission and Soil Conservation Service personnel and projected from knowledge and surveys of comparable areas.

Table 37-1.--Wyoming: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Projects administered from Billings, Montana						
Big Horn	4,578	0	---	1,730	350	0
Bogen	42,632	0	---	0	---	0
Clarks Field	59,445	0	---	0	---	0
Greybull Flat	2,669	0	---	980	350	0
Hanover Bluff	1,600	0	---	0	---	470
Keyhole	16,134	0	---	0	---	0
Moorhead	3,856	0	---	0	---	0
Owl Creek Unit	1,365	0	---	0	---	0
Paintrock	3,046	0	---	560	350	0
Shoshone Ext	138,069	0	---	30,000	350	27,000
Yellowstone	20,533	0	---	0	---	0
Riverton	144,862	0	---	30,360	300	0
Shoshone	104,498	0	---	2,010	350	0
Projects administered from Salt Lake City, Utah						
Eden	56,817	0	---	0	---	0
Opal	3,520	0	---	0	---	0
Flamingo Gorge	91,357	0	---	0	---	0
Lyman	992	0	---	0	---	0
Savery Pot Hook	1,486	100	---	200	250	0
Seedskadee	199,345	0	---	37,007	225	0

Table 37-1.--(cont.) Wyoming: Bureau of Reclamation-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Project	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Sublette	22,494	0	---	0	---	0
Transmission	741	0	---	0	---	0
Projects administered from Boise, Idaho						
Minidoko	22,564	0	---	0	---	0
Palisades	3,804	0	---	0	---	0
Total	946,407	100	---	102,847	---	27,470

Contacts: John Robertson, Head, Land Uses and Recreation Branch; D. Merlin Archibald, Natural Resource Specialist, Billings, Montana; L. M. Butterfield, Chief of Land Branch; Paul Schaffer, Chief of Land Resources, Salt Lake City; John H. Welch, Land Management Division, Boise, Idaho. Data were developed from Bureau of Reclamation record files on land classification of land suitable for agriculture production.

Table 37-2.--Wyoming: Bureau of Land Management-estimated acres and value of federal public lands suited for intensive agriculture, 1968

District	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Worland	3,115,000	0	---	25,575	185	342,650
Lander	2,147,000	10,000	30	21,750	185	254,800
Rawlins	3,835,000	58,000	75	31,000	118	575,000
Rock Springs	5,319,000	50,000	75-120	159,570	130	525,520
Pinedale	958,000	5,000	75	25,850	130	60,850
Casper	2,496,000	80,000	50-75	20,000	175	157,000
Total	17,870,000	203,000	---	283,745	---	1,915,820

Contacts: Ed Pierson, State Director, Cheyenne, Wyoming; Technical Program Staff, Soil Conservation Service, Casper, Wyoming; Soils Department, State Experiment Station, Laramie, Wyoming. Data are estimates and were developed, with assistance of Soil Conservation Service, by projecting acreages from Conservation Needs Inventory sampled areas and by checking capability classes and subclasses.

Table 37-3.--Wyoming: National Park Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Park/Recreation Area	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
National Parks in Wyoming	2,309,167	3,000	---	0	---	4,000
Fort Laramie						
Devil's Tower						
Grand Teton						
Bighorn Canyon						

Contact: Harvey B. Reynolds, Acting Regional Director, Omaha, Nebraska. Data were estimated and projected from generalized reports and Conservation Needs Inventory.

Table 37-4.--Wyoming: Bureau of Sport Fisheries and Wildlife-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Refuge	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Baimforth	1,165	0	---	0	---	0
Hutton Lake	1,967	0	---	0	---	0
National Elk	23,970	0	---	800	2,500	1,500
Pathfinder	3,010	0	---	0	---	0
Seedskadee	8,323	0	---	0	---	0
Total	38,255	0	---	800	---	1,500

Contact: William T. Krummes, Regional Director, Albuquerque, New Mexico. Data are estimates and were developed from soil surveys, judgment of specialists, and field evaluation by refuge managers.

Table 37-5.--Wyoming: U.S. Forest Service-estimated acres and value of federal public lands suited for intensive agriculture, 1968

National Forest	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Big Horn	1,113,769	50,000	45	0	---	60,000
Medicine	1,094,824	25,000	40	0	---	35,000
Shoshone	2,424,937	125,000	40	0	---	250,000
Black Hills	172,443	10,000	40	0	---	15,000
Thunder Basin L. U. Lands	572,310	50,000	50	0	---	125,000
Others	3,789,298	0	---	0	---	0
Total	9,167,561	260,000	---	0	---	485,000

Contacts: Earl Hendrickson, Assistant Regional Forester, Denver, Colorado; Technical Program Staff, Soil Conservation Service, Casper, Wyoming. Data are estimates and were projected from sampled conservation needs studies with the assistance of Soil Conservation Service.

Table 37-6.--Wyoming: Department of Defense-estimated acres and value of federal public lands suited for intensive agriculture, 1968

Agency	Total Acres	Arable Lands (dryland)		Irrigable Lands (water avail.)		Irrigable Lands (water not avail.)
		Acres	Value/ acre $	Acres	Value/ acre $	Acres
Army	9,745	1,000	---	0	---	1,000
Air Force	9,304	500	---	0	---	500
Navy	9,323	1,500	---	0	---	1,500
Total	28,372	3,000	---	0	---	3,000

Contact: Department of Defense, Washington, D. C. Data are estimates and were developed from generalized reports, Conservation Needs Inventory, and sampled area studies.

Federal Public Land Laws and Policies Relating to Intensive Agriculture

WORKING PAPER

Federal Public Lands: Their Potential Contribution to Food and Fiber Needs, 1980 and 2000

Prepared for the

Public Land Law Review Commission

Washington, D. C.

By

The Economics Department

Agricultural Experiment Station

South Dakota State University

Brookings, South Dakota 57006

APRIL 30, 1969

REVISED OCTOBER 1969

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This study is part of the research being done by the University under contract with the Public Land Law Review Commission. The opinions, findings, conclusions and data expressed in this publication are those of the authors and not necessarily those of the Public Land Law Review Commission. This publication constitutes only one of a number of sources of information utilized by the Commission in the conduct of its public land study program.

FEDERAL PUBLIC LANDS: THEIR POTENTIAL CONTRIBUTION TO FOOD AND FIBER NEEDS

Russell L. Berry

I. INTRODUCTION

It is common knowledge that the world's population is increasing at an unprecedented pace. Food supply has become a major world problem particularly in the underdeveloped countries and is also a matter of concern in the developed countries where population is increasing at a slower rate and agricultural productivity is high. In view of these trends and the expected demand for food, what is the potential contribution of the federal public lands to future food and fiber needs?

Total non-federal, non-urban cropland of varying quality totals 638 million acres in the 50 States. About 336 million acres are now in use, and 80 million additional acres could be returned to use in a short time. Urbanization is using approximately 200,000 acres of cropland per year.[1] Federal public lands comprise 371 million acres in 17 Western States. However only 3.3 million acres are classed as presently arable for either dry or irrigated farming. Another 35 million acres are considered irrigable, but water is not now either legally or physically available for them.

The purpose of this report is to assess the potential role of federal public lands in satisfying future food and fiber needs by reviewing (1) the projected trends in population, (2) the projected food and fiber needs, (3) the acres of cropland that will be required to produce the food and fiber needed, and (4) the potential contribution

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[1] Food & Fiber for the Future, report of the National Advisory Commission on Food and Fiber (Washington, D.C.: U.S. Government Printing Office, 1967), pp. 243-245.

Russell L. Berry is Associate Professor of Economics at South Dakota State University. Edward P. Hogan, Assistant Professor of Geography also at South Dakota State University, prepared some preliminary information on population, food needs, and crop production.

of the federal public lands to these needs. This analysis assumes that the maximum public benefit will be achieved if food and fiber needs are met at least cost.

II. FUTURE POPULATION PROJECTIONS AND FOOD AND FIBER NEEDS, 1980 AND 2000

Other things being equal, the demand for food varies directly with the number of people. If world population doubles by 2000, food requirements will also double--especially in those areas of the world where food is barely sufficient to maintain life. With rising incomes the resulting increase in demand for food will probably mean that world supplies will need to increase by two and a half to three times. Hence any study of the future demand for food must begin with a study of population prospects or trends.

World Population and Food and Fiber Needs

If present trends continue, world population is expected to double by the year 2000. In 1965 it was estimated to be 3.3 billion, and the medium projection for the year 2000 is 6.0 billion (Table 1). The most rapid increases are taking place in Asia, Africa, and Latin America, areas of the world least able to bring their burgeoning population into balance with their food supplies. Asia had 1.8 billion people in 1965--56 percent of the total world population. If current trends continue, even the medium projections indicate increases of 30 percent by 1980 and 80 percent by 2000. African population is expected to increase 60 percent by 1980 and 150 percent by 2000, and in Latin America anticipated increases are 50 percent by 1980 and 150 percent by 2000. In contrast, population increases in Europe will probably be only about 10 percent by 1980 and 20 percent by 2000.

The rapid population increases expected in Asia, Africa, and Latin America are largely due to health and sanitation improvements which have reduced infant mortality and increased longevity. These desirable measures introduced by the United Nations, national governments, and private organizations have had the ironic effect of preventing death by disease but increasing the likelihood of malnutrition and death by starvation. It is now being recognized that malnutrition, particularly during infancy, may have most serious effects on mental as well as on physical ability.

Table 1.--Major world area population estimates for 1965 and medium projections for 1980 and 2000

Area	Estimate mid-1965	Medium projections		Increase over 1965	
		1980	2000	1980	2000
	Millions			Percent	
Africa	311	449	768	63	147
Asia (total)	(1,842)	(2,404)	(3,307)	(30)	(80)
East Asia	867	1,038	1,284	20	48
South Asia	975	1,366	2,023	40	107
Europe	443	479	527	8	19
Latin America	248	374	624	51	152
North America	215	262	354	22	65
Oceania	17	23	32	35	39
U.S.S.R.	234	278	353	19	51
World total	3,308	4,269	5,965	29	80

Source: Population Bulletin (October 1965), p. 96.

The National Advisory Committee on Food and Fiber notes that the developing regions not only have two-thirds of the world population but that their populations are growing at almost twice the rate of developed countries with adequate diets. Furthermore, the Committee declares "if current trends in population, food demand and production continue, by 1980, the food deficit of the developing regions could be too large for the physical and financial capabilities of the developing regions to overcome it."[2]

In this dismal situation, food aid programs may be only a short-run palliative. Unless these programs are used with care, they can ruin market prices for native farmers and thereby discourage increased production. Food aid can also mask the need for population control and food production in the underdeveloped countries. But even effective efforts to control population and produce food may be too late to forestall severe pressure on supplies, and food aid will still be needed in increasing amounts to prevent famines such as recently ocurred in India as a result of drought. But in the long run these countries must produce most of their own food or purchase it on world markets. (Trends in world food production per capita are shown in Figure 1.)

In some cases food aid can be used in underdeveloped countries to good advantage as incentive payments for labor in the construction of farm-to-market roads and other similar projects that will help the people become more self-sufficient. In general, aid should be centered on providing and developing teaching, training, research, and demonstration institutions. New capital for agriculture should also be emphasized. Seeds, fertilizers, insecticides, hand tools, and machinery are examples of pressing needs. In the short run, capital may have to come from foreign sources, but as soon as possible it should be provided by the peoples themselves with the aid and assistance of their governments.[3]

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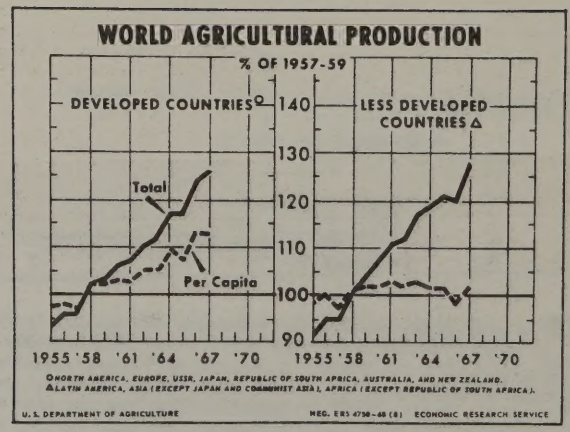
[2] Food & Fiber for the Future, National Advisory Commission on Food and Fiber, p. 306.

[3] Rutillis H. Allen, "The Role of Agriculture in World Economic Development," Agriculture and Foreign Economic Development, Technical Papers, Vol. VII, National Advisory Commission on Food and Fiber (1967), pp. 1-33.



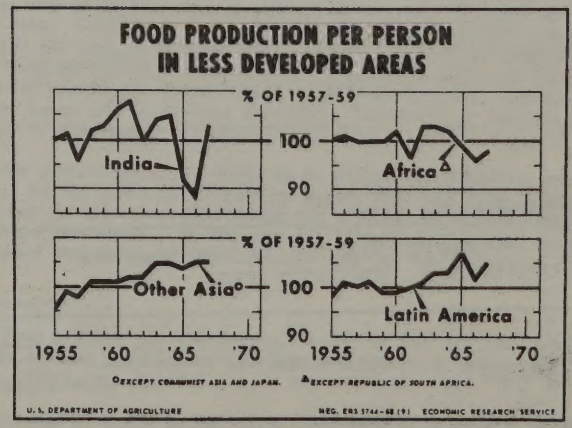


Figure 1

New Low Cost Foods

Crop yields in other countries will continue to increase rapidly, although at a slower pace than population, if present trends continue.

Arthur and others have called attention to new low-cost foods that may be developed to help feed the world's growing population.[4] They point out that one of the serious food shortages is protein. At present, about 50 million metric tons of fish are harvested yearly, but it is estimated that this harvest could be increased to 250 million metric tons if more efficient methods were used and fish now unmarketable are utilized.

Synthetic milk and meats from soybean, peanut, sunflower, and safflower proteins may greatly improve efficiency in production of needed proteins. Feeding these products to livestock in order to produce milk and meat is relatively inefficient.

A fish protein concentrate (FPC) that is virtually odorless and tasteless may be an inexpensive way of providing needed proteins when added to conventional foods such as stews, soups, tortillas, and bread.

A new rice variety (IRI-8) could double the world's rice production in the next 10 years. By the year 2000, production may have increased many times.

A new field corn (Opaque 2) is capable of producing most of the amino acids that the body needs. General use of such a corn might greatly reduce malnutrition in Latin America where corn is a staple food.

Lysine, an amino acid derived from fermented molasses, is a promising new food supplement that can be added to conventional foods to provide proteins almost equal to those in milk and meat.

Yeasts, used during World War II in Germany, are also a promising source of protein although somewhat deficient in amino acids. Other micro-organisms can also be used such as fungi imperfecti which synthesize proteins from products like blackstrap molasses, sweet potatoes, and corn starch.

Algae farming is an especially promising source of foods and feeds for the future. Algae are most efficient converters of solar energy into foods and produce yields 20 to 40 times greater than most

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[4] H. B. Arthur, R. A. Goldberg and K. M. Bird, The United States Food and Fiber System in a Changing World Environment, Technical Papers, Vol. IV, National Advisory Commission on Food and Fiber, p. 58.

farm crops. They are high in protein, but not so high as meat and fish; they are also fairly high in vitamins. Production costs are estimated to be $40 to $100 per ton of 50 percent protein food, a cost that compares favorably with soybean proteins.

There are a number of other possibilities for developing foods for the future. Arthur and others suggest that in the years ahead food may come from such strange sources as petroleum, methane gas, and chemical synthesis.[5] Their estimates of the probability of commercial success by 1980 of the products discussed above are as follows:

Product	Percentage
Lysine to supplement grains	95
IRI-8 rice	95
Opaque 2 corn	90
Fish protein concentrates	95
Protein foods from soybeans, peanuts, etc.	80
Soybean milk	60
Fungi proteins	20
Protein foods from petroleum	3
Protein foods from sea water	5
Protein foods from sewerage wastes	7
Protein foods from industrial wastes	5
Plankton, chemical synthesis and synthetic energy compounds	½

Perhaps by the year 2000 other possibilities will have been developed to meet food and fiber needs beyond that date.

Foreign Demand for U.S. Food and Fiber

Despite the rapidly growing populations in the developing countries, the strongest export markets for U.S. food and fiber are still found in the developed countries (Figure 2). In 1968, Japan was our best commercial market for agricultural exports. Canada, the Netherlands, the United Kingdom, West Germany, and Italy followed in that order. India took $500 million worth of farm products, but these were all under U.S. government programs. Pakistan and South Vietnam also received considerable government-sponsored farm exports.

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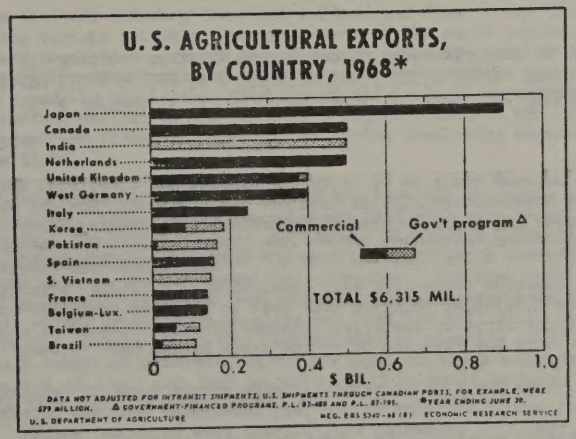
[5] Ibid., pp. 58-59.



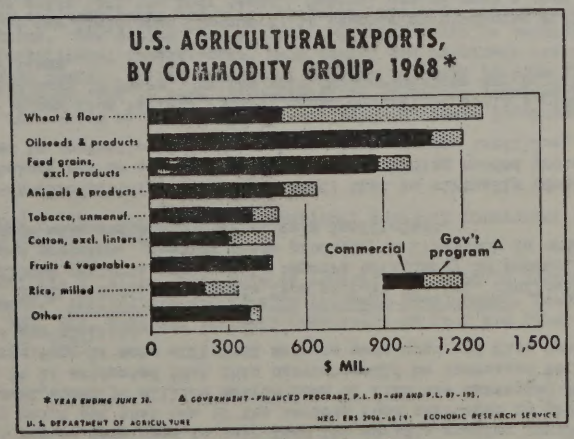


Figure 2

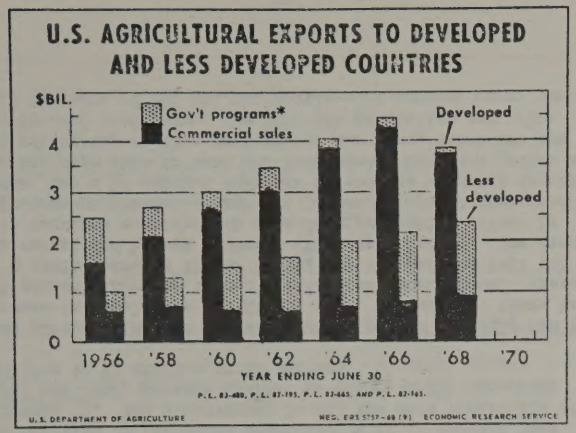
In the United States, total cropland harvested fell from 324 million acres to about 300 million during the last decade. At the same time, croplands harvested for export increased from about 50 million to 75 million acres--50 percent. Farm exports are expected to remain strong and even increase in years ahead, but this increase is not expected to be great enough to warrant concern about our capacity to produce the foods demanded at home. Exports tend to be the surplus after domestic needs are met and to this extent are not competitive with local markets. The role of government programs in present major food exports is shown in Figure 3. While such programs probably will be continued, the vast food needs of developing countries can be transformed into effective demand only over a relatively long period. Their use of our farm products for the next 30 years will probably depend heavily on foreign aid policies pursued by the United States.

Thus the primary concern is whether future domestic demands for food and fiber warrant the development of the remaining federal public lands for dry or irrigated crop production at this time. Since population in underdeveloped countries threatens to outrun food supply, will population in the United States also outrun our capacity to produce?

Future U.S. Population and Food Needs

Despite the steady population increase in the United States there has been no food shortage in this country. Price-depressing surpluses of foods and fibers have led to farm programs that have idled over 60 million acres of cropland. Since 1950 total food consumption has increased more rapidly than population. (U.S. trends in population and food production are shown in Figure 4.)

But what of the future? Population projections for the United States are presented in Table 2. The medium-high projections are for a 25 percent increase by 1980 and a 75 percent increase by the year 2000. If these projections prove to be accurate, food and fiber needs will also increase 25 percent by 1980 and 75 percent by 2000. These needs can be met by a comparable increase in cropland, a comparable increase in yields, by imports, or by some combination of these methods.



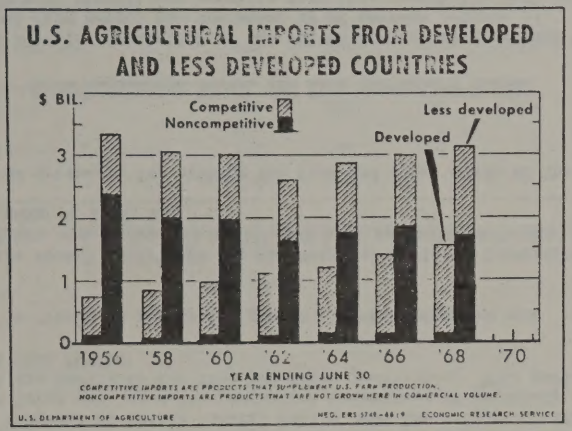


Figure 3

Table 2.--Estimated population of the United States for 1965 with projections for 1980 and 2000

Year and level	Population estimate (millions)	Increase over 1965 (percent)
1965 estimate	193.8	---
1980 projections		
Low	227.7	17
Medium-low	235.2	21
Medium-high	243.3	26
High	250.5	29
2000 projections		
Low	282.6	46
Medium-low	307.8	58
Medium-high	336.0	73
High	361.4	86

Sources: U.S. Department of Commerce, Population Estimates, Bureau of the Census, Series P-25, No. 375 (3 October 1967), p. 18; Series P-25 No. 381 (18 December 1967), pp. 76, 77, 94, 95.

III. PRIVATE CROPLANDS: CAN THEY MEET FOOD AND FIBER NEEDS OF 1980?

Whether or not the maximum benefit of the general public will be served by disposal of arable federal public land for crop production depends in large part upon the production potentials of privately owned lands that are available for food and fiber production. This part of the report will review:

(a) the trends in population growth, food consumption and production,

(b) the recent study made for the National Advisory Commission on Food and Fiber concerning the ability of U.S. agriculture to meet food and fiber needs of 1980, and

(c) the prospects for meeting the food and fiber needs of the year 2000.

U.S. Population Growth and Farm Production Trends

Since 1950 the population of the United States has increased by 32 percent, but farm output has increased by 42 percent (Figure 5). Perhaps the most significant point is that this remarkable increase in production was achieved by a 52 percent increase in crop yields and a 34 percent increase in livestock production with 10 percent less cropland (Table 3). The achievement is all the more remarkable since between 1955 and 1967, acreage devoted to export crops increased from 47 million to 71 million, or 50 percent.

The 42 percent increase in farm production has not only fed the sharp increase in population but fed it well. Since 1950 there has been a 4.5 percent increase in per capita food consumption. There has also been a sharp increase in per capita use of beef and veal and a decline in cereal and bakery products (Figures 6 and 7). The result is a diet that requires considerably more farm production either by increasing acres or yields. Despite a 32 percent population growth, better diets, and a 50 percent increase in acreage of crops exported, the nation has been able to meet the food needs that have arisen since 1950. But reassuring as this performance has been, there are new challenges to food production. By 1980 the population may rise to the high estimate of 243 million people -- 25 percent above the 1965 level.

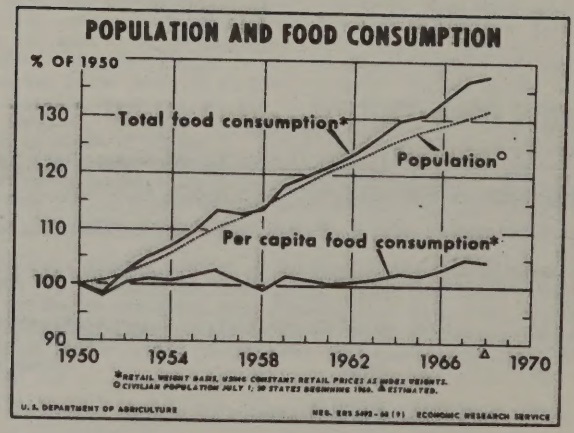


Figure 4

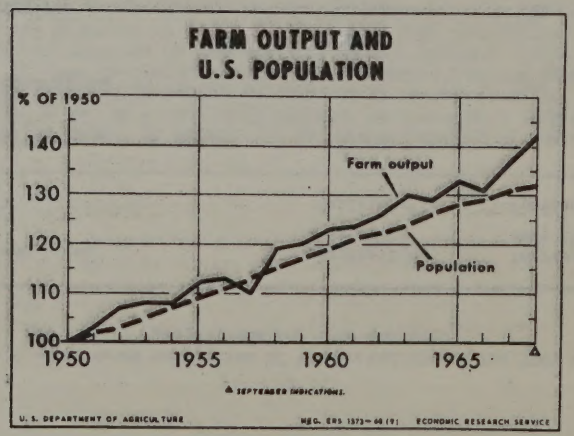


Figure 5

Table 3.--Trends in population and crop and livestock production, United States, 1950-1968

	1950	1955	1960	1965	1968
	Index numbers				
U.S. population	100	109	119	128	132
Farm output	100	112	123	133	142
Livestock production	100	112	116	126	134
Crop production	100	108	121	129	137
Crop production per acre	100	108	130	145	152
Cropland used for crops	100	100	93	89	90

Source: U.S. Department of Agriculture Handbook of Agriculture Charts 1968, p. 10.

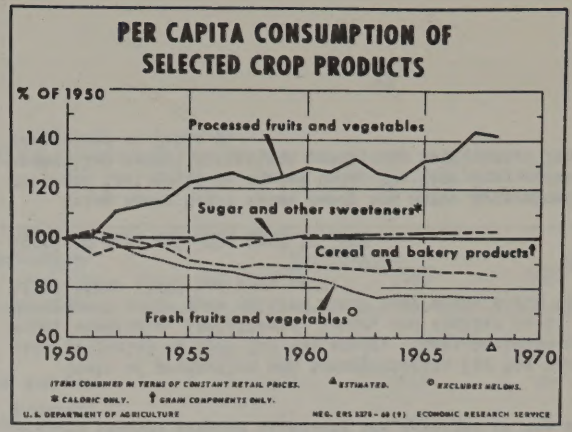


Figure 6

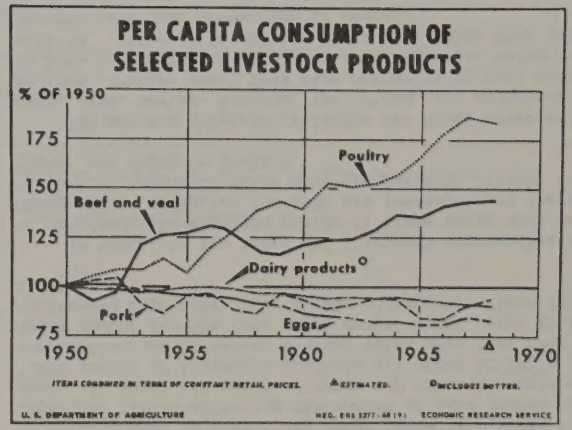


Figure 7

Given expected trends in crop yields and per capita consumption, would this increase in population, plus increased foreign demand, exhaust the supply of idle cropland by 1980?

U.S. Agriculture and Food Needs, 1980

Whether or not agriculture in the United States can meet the food and fiber demands of the population of 243 million expected by 1980 has been recently studied by Heady and Mayer for the National Advisory Commission on Food and Fiber.[6] Their work, reviewed here in detail, should be of much help to the Public Land Law Review Commission as it seeks to determine what should be done with federal lands suited to crop production. The study could not have been made without a powerful tool, a multi-regional linear program, which Heady and Mayer used for the 144 producing and 31 demand regions involved. The authors studied four alternative "free market" farm programs (models) and found that an excess of 47 to 78 million acres existed under the first three plans so that only "a policy of exporting all quantities of major crops above domestic needs which the agricultural sector is able to produce" would exhaust the nation's excess capacity of 56 million acres of idle land by 1980. Heady and Mayer concluded that "given any policy other than all-out production, it is evident from the models analyzed that the agricultural economy will continue to have surplus capacity for the forseeable future."[7]

The authors note that "unless society changes its views on what constitutes equitable returns to landowners, it is probable that programs for removing land from production will continue." Therefore, they analyzed models of three "controlled market" farm programs that involve restrictions on crop production. Their analysis revealed excess capacity with 45 to 71 million acres of idle land.

Consumption Rates and Total Demand

Obviously the number of acres of land that were found to be idle depends not only upon the population expected (243.4 million) but also upon per capita consumption, feeds required to produce livestock products consumed, expected level of exports, and finally, expected crop yields.

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[6] Earl O. Heady and Leo V. Mayer, Food Needs and U.S. Agriculture in 1980, Technical Papers, Vol. I, National Advisory Commission on Food and Fiber, p. 63.

[7] Ibid., p. 70.

Per capita food consumption is an important factor affecting the needs for foods and fibers in 1980 and hence the amount of idle acres. Since the consumption estimates used by Heady and Mayer in Table 4 are considerably higher than dressed or refined product rates would be, it appears that their rates are for live weight and unmilled grains.

Efficiency in converting rough feeds into human foods is also an important factor affecting the amount of land needed in the future. The Heady and Mayer estimates of feeds and oilmeal required to produce 1,000 pounds of livestock products are shown in Table 5. These human consumption and livestock feeding rates were then used to project the total demand for the four major crops--wheat, feed grains, soybeans and cotton--to 1980 under four levels of export. These figures are shown in Table 6.

To translate the human and livestock consumption rates into acres of cropland, the expected yields of these crops must be estimated. The Heady--Mayer estimates for 1980 are presented and compared with historical trends of these crops in Table 7. Yields for the various States are shown in Table 8.

The maximum cropland available for these seven major crops--wheat, corn, oats, barley, sorghum, and cotton--was assumed to be equal to the maximum acreages which have been harvested in past years. For example, in 1965 the harvested and idled acres of these seven crops was 252 million. Although 56 million acres were idle, they could easily be brought back into production if needed.

Lands devoted to tame hay were not included in the study. Other minor crops and fruits and vegetables were also omitted. In 1967, a total of 6.6 million acres of vegetables, fruits and nuts was harvested. Therefore, if demand warranted, their acreages could be doubled or tripled without greatly affecting the acreages of the seven major crops studied.

Costs of production and transportation for the various crops were also projected to 1980 for the study. These included machinery, power, seed, chemicals, fertilizers, labor, and similar costs. Land and management costs were omitted since they would claim the net returns after other costs had been paid.

Cropland Used and Idle Land in 1980

Using these basic rates Heady and Mayer determined the amount of cropland that would be needed under the four free market and three controlled market situations previously mentioned. The results are summarized in Table 9.

Table 4.--Estimated per capita consumption for 1964 with projection used in study of food and fiber needs for 1980

Commodity consumed	Per capita consumption		Increase	
	1964	1980	1950 1964	1964 1980
	- - - - Pounds - - - -		- - Percent - -	
Livestock products				
Beef and Veal	183.8	203.5	47	11
Pork	107.5	97.0	1	-10
Lamb and Mutton	8.6	7.2	5	-16
Broilers	31.2	50.2	11	61
Turkeys	7.2	11.8	16	64
Dairy products	628.0	570.0	-5	-9
Eggs(number)	314.0	290.0	-7	-8
Grain products				
Wheat	160.0	142.8	-2	-11
Corn	53.0	51.1	1	-4
Oats	7.8	8.0	3	3
Barley	1.4	1.1	0	-22
Fiber products				
Cotton	22.1	21.6	-30	-2

Sources: Heady and Mayer, Food Needs and U.S. Agriculture in 1980, Table 3 (per capita consumption only)--these estimates are for undressed and unrefined products of farm. Statistical Abstracts of the United States 1967, p. 88 (1950 and 1964 statistics).

Table 5.--Estimated feed grains and oilmeal required to produce 1,000 pounds of animal product, 1964 and 1980

Livestock fed	Feed Grains		Oilmeals	
	1964	1980	1964	1980
	- - - - - - - - - - Pounds - - - - - - - - - -			
Beef and veal	1302	1417	244	315
Pork	4666	4764	264	312
Lamb and mutton	966	973	658	571
Dairy cattle (milk)	322	317	52	64
Turkeys	2626	2451	(a)	(a)
Hens and pullets (eggs)	297	234	(a)	(a)
Broilers	1752	1482	(a)	(a)

Source: Heady and Mayer, Food Needs, Table 4.

[a]Not estimated by class.

Table 6.--Domestic use and export of four major crops for 1965 and projected levels for 1980

Plan	Wheat	Feed grains	Oilmeals	Cotton
	bushels	tons	tons	bales
	- - - - - - - - - - - - Millions - - - - - - - -			
Actual level, 1965				
Domestic	587	130	17	9
Export	867	29	11	4
Projected use, 1980				
Domestic	720	154	20	10
Export levels				
Actual level, 1965	867	29	11	4
Trend level, 1950-1965	1302	40	24	6
Dumping level	2157	70	37	7
Commercial level	560	36	17	5

Source: Heady and Mayer, Food Needs, Table 6. Figures rounded.

Table 7.--Crop yields for 1948 and 1965 with projections used in study of food and fiber needs for 1980

Crops Studied	Yields per acre			Percentage increase	
	1950	1965	1980	1950 1965	1965 1980
Wheat, bu.	16.5	27.2	32.3	65	19
Soybeans, bu.	21.7	24.6	29.3	13	19
Corn, bu.	38.2	73.1	99.4	91	36
Oats, bu.	34.8	50.2	59.1	44	18
Barley, bu.	27.2	43.5	48.6	60	12
Sorghum, bu.	23.4	50.0	61.8	114	24
Cotton, lbs.	26.9	53.2	75.4	98	42

Sources: Agricultural Statistics 1965; Heady and Mayer, Food Needs, Table 2.

Table 8.--Yields of major field crops, actual 1965 and projected 1980

Area	Bushels per acre												Cotton (Pounds per acre)	
	Wheat		Soybeans		Corn		Oats		Barley		Grain sorghum			
	1965	1980	1965	1980	1965	1980	1965	1980	1965	1980	1965	1980	1965	1980
United States	27.2	32.3	24.6	29.3	73.1	99.4	50.2	59.1	43.5	48.6	50.0	61.8	532	754
New York	36.0	43.6	15.0	19.2	57.0	73.4	55.0	73.0	40.0	47.5	—	—	—	—
New Jersey	35.0	41.7	23.5	28.9	68.0	90.8	37.0	44.9	48.0	59.7	—	—	—	—
Pennsylvania	34.0	39.9	24.0	26.5	65.0	79.4	46.0	60.7	48.0	48.8	—	—	—	—
Ohio	32.0	40.2	24.5	30.5	75.0	95.2	56.0	79.4	42.0	41.1	—	—	—	—
Indiana	34.0	48.5	28.0	35.4	94.0	116.1	52.0	69.6	38.0	50.2	70.0	87.1	—	—
Illinois	35.5	49.0	29.0	34.0	92.0	115.2	57.0	69.7	39.0	38.9	64.0	75.1	—	—
Michigan	33.0	45.6	22.0	28.8	62.0	87.9	49.0	65.6	39.0	51.1	—	—	—	—
Wisconsin	32.4	45.3	18.5	19.8	76.0	95.0	61.0	77.4	50.0	55.3	—	—	—	—
Minnesota	27.8	31.6	18.5	26.6	61.0	80.3	55.0	64.0	44.0	45.2	—	—	—	—
Iowa	19.0	30.2	25.5	34.3	82.0	109.2	54.0	63.3	44.0	53.3	67.0	83.2	—	—
Missouri	27.5	43.7	26.0	30.8	72.0	87.0	36.0	48.7	32.0	41.6	57.0	70.3	575	793
North Dakota	26.5	25.7	18.0	17.9	37.0	45.6	52.0	60.7	41.0	46.3	—	—	—	—
South Dakota	18.0	19.5	17.0	20.5	39.0	48.0	48.0	48.5	38.0	40.9	30.0	53.2	—	—
Nebraska	20.0	29.3	24.0	34.3	67.0	89.9	40.0	45.4	30.0	34.8	54.5	78.5	—	—
Kansas	24.0	30.0	20.0	23.3	59.0	76.4	32.0	40.8	26.5	35.9	45.0	53.4	—	—
Delaware	36.0	40.0	25.0	29.6	75.0	86.4	38.5	28.6	43.0	58.1	—	—	—	—
Maryland	33.0	36.5	27.0	32.3	74.0	84.0	46.5	57.1	43.0	51.8	—	—	—	—
Virginia	30.0	36.2	20.5	25.0	68.0	71.9	43.0	40.7	43.0	58.7	42.0	47.6	298	367
West Virginia	29.0	34.7	—	—	50.0	57.5	39.0	52.2	41.0	46.9	—	—	—	—
North Carolina	29.0	36.5	24.5	34.2	70.0	90.5	43.0	44.8	38.0	49.1	48.0	31.4	286	423
South Carolina	27.0	34.2	22.5	30.1	56.0	73.1	38.0	45.6	35.0	47.9	30.0	36.8	480	527
Georgia	29.0	39.0	20.5	26.5	51.0	71.0	41.0	56.8	31.0	49.3	34.0	37.3	460	629
Florida	—	—	26.0	28.2	44.0	64.4	38.0	54.0	—	—	—	—	313	489
Kentucky	32.0	40.3	24.0	31.2	69.0	89.8	37.0	52.0	34.0	44.2	40.0	54.9	—	—
Tennessee	28.0	35.7	23.5	31.3	52.0	68.6	39.0	48.6	28.0	39.0	41.0	52.4	634	836
Alabama	26.0	35.1	23.0	34.0	44.0	58.9	34.0	46.0	—	—	26.0	33.7	490	632
Mississippi	28.0	30.1	22.5	28.3	40.0	55.3	40.0	54.0	—	—	35.0	45.2	691	930
Arkansas	26.0	44.1	21.5	26.3	37.0	49.1	50.0	68.9	30.0	39.9	35.0	39.9	611	817
Louisiana	21.0	35.5	21.5	31.2	35.0	48.0	27.0	41.5	—	—	35.0	40.0	553	775
Oklahoma	28.0	29.8	15.5	24.4	34.0	47.6	34.0	40.2	31.0	36.1	37.0	41.2	300	448
Texas	22.5	24.6	28.0	32.4	33.0	45.1	25.0	31.0	19.0	28.9	52.0	62.1	408	583
Montana	25.6	25.9	—	—	60.0	100.3	44.0	44.9	39.0	35.7	—	—	—	—
Idaho	44.9	47.9	—	—	78.0	112.7	57.0	68.2	52.0	53.0	—	—	—	—
Wyoming	12.8	21.8	—	—	55.0	112.0	39.0	43.5	43.0	47.0	—	—	—	—
Colorado	15.7	18.6	—	—	70.0	111.3	38.0	49.0	39.5	43.8	35.5	39.1	—	—
New Mexico	24.5	27.0	—	—	55.0	84.5	37.0	61.0	46.0	73.6	65.0	76.7	699	960
Arizona	46.0	61.6	—	—	27.0	39.9	42.0	55.4	73.0	94.3	70.0	89.9	1,066	1,330
Utah	32.3	27.4	—	—	71.0	97.4	55.0	59.4	60.0	61.9	—	—	—	—
Washington	40.0	46.4	—	—	75.0	129.0	54.0	55.1	49.0	56.1	—	—	—	—
Oregon	37.4	43.9	—	—	74.0	111.9	50.0	69.9	46.0	49.0	—	—	—	—
California	26.5	34.2	—	—	84.0	129.3	44.0	53.7	51.0	72.0	73.0	97.9	1,126	1,314

Source: Heady and Mayer, Food Needs, Table 2.

Table 9.--Major crops and idle land, United States, 1965 with projections for 1980 under seven market situations

Market plan	Wheat	Feed grains	Soybeans	Cotton	Idle land
	- - - - - - - - - - - - - - - - Millions of acres - - - - - - - - - - - - - - - -				
Present Plan, 1965	49.3	99.0	34.6	13.6	56.0
"Free markets," 1980					
A Cotton acreage controls; exports at 1965 level	59.7	73.9	29.3	10.0	78.4
B Cotton acreage controls; exports at 1950-65 trend	69.4	81.0	42.5	11.3	47.0
C No controls; exports at 1950-65 trend	70.0	81.2	42.6	9.3	48.0
D No controls; export dumping	88.7	94.4	58.6	9.7	0.0
Controlled markets, 1980					
E Feed-grain program exports at 1950-65 trend	62.5	89.2	43.1	11.0	45.6
F Acreage quotas; exports at 1950-65 trend	63.2	96.4	42.2	11.5	38.0
G Acreage quotas; commercial exports only	42.2	93.7	33.8	10.3	71.3

Source: Heady and Mayer, Tables 7, 11, 15, 19, 23, 27, and 31. Assumes 251.2 million acres are used for these crops. Feed grains include corn, oats, barley, and sorghum. Hay and minor crops omitted.

The four free market farm programs were analyzed to provide a benchmark for the three controlled market situations that Heady and Mayer believed most likely to prevail in the future. The free market plans result in greatly expanded wheat and soybean production as compared with 1965. Feed grains production would fall by about 20 million acres unless all surpluses are dumped on the world market.

Cotton acreage quotas are assumed to be in use with Plans A and B, but the least amount of cotton is produced with no controls, as shown for Plan C and D (Table 9). This indicates that cotton cannot compete with wheat, feed grains, and soybeans in some areas and raises questions about the need for cotton acreage controls.

Idle land will increase under Plan A from 56 to 78 million acres, a 40 percent increase, unless exports exceed 1965 levels. But even when exports are projected with 1950-65 trends in Plans B and C, only eight to nine million of the 56 million acres of idle land are needed for food and fiber production.

Controlled markets achieved by feed grain programs or acreage quotas would result in the production of somewhat less wheat than under free market conditions but in more feed grains produced (compare B and C with E and F).

In any event, only Plan D which calls for greatly expanded exports in 1980 would generate enough demand to utilize the excess capacity of U.S. agriculture as represented by 56 million acres of idle land in 1965. But Plan D is undoubtedly the most unrealistic of the seven plans. Wheat would have to sell for $4.40 per bushel to attract all the idle land into production (Table 10). Under the assumptions made in this study concerning consumption, yields, and exports, it seems probable that 40 to 60 million acres of idle cropland will still be available in 1980 to help meet the food and fiber needs between 1980 and 2000.

The probable location of these idle lands under two free market plans and two controlled market plans is shown in Figure 8. Under the free market plan, lands would be idled because they are not productive enough to pay the costs involved. In contrast, government programs tend to idle land more uniformly over the country regardless of its profitability.

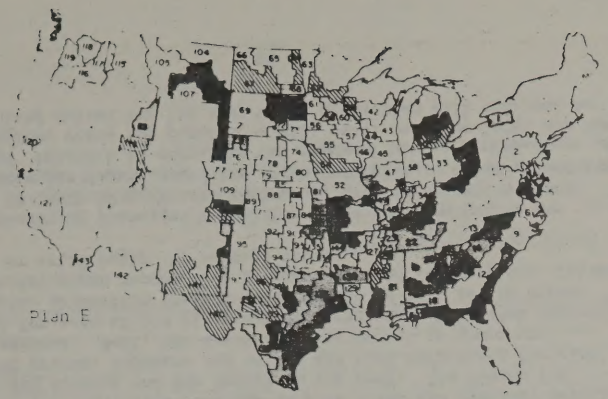
Free Markets versus Controlled Markets

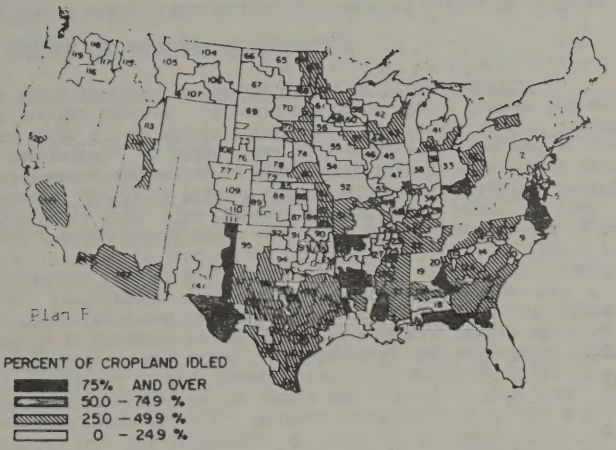
Will increased demands make possible a reliance on free markets to provide farmers and landowners with satisfactory prices in the future? Or will the federal government still find price support programs irresistible in 1980?

Table 10.--Prices required to secure production in the highest cost area needed to meet expected consumer demand in 1980

Market plan	Wheat bu.	Feed grains bu.	Soybeans bu.	Cotton lb.
	Dollars per unit			
1965 (actual)	1.34	1.10	2.49	.28
"Free Market" plans				
A	1.11	.69	1.13	.26
B	1.27	.76	1.25	.27
C	1.27	.75	1.23	.17
D	4.40	2.53	6.19	.24
Controlled market plans				
E	1.49	.78	1.28	.31
F	1.92	1.48	1.19	.44
G	1.17	1.41	1.04	.41

Source: Heady and Mayer, Food Needs, Tables 8, 12, 16, 20, 24, 28, and 32.

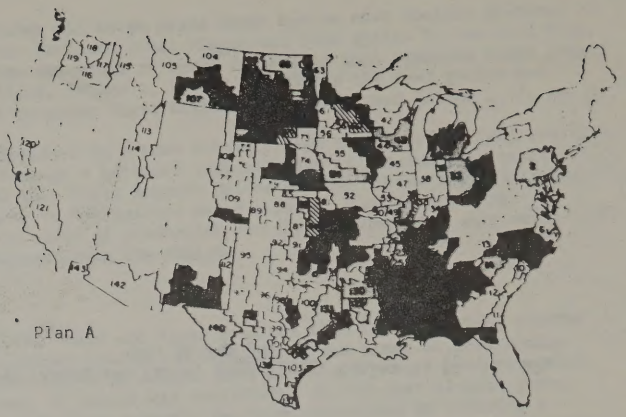


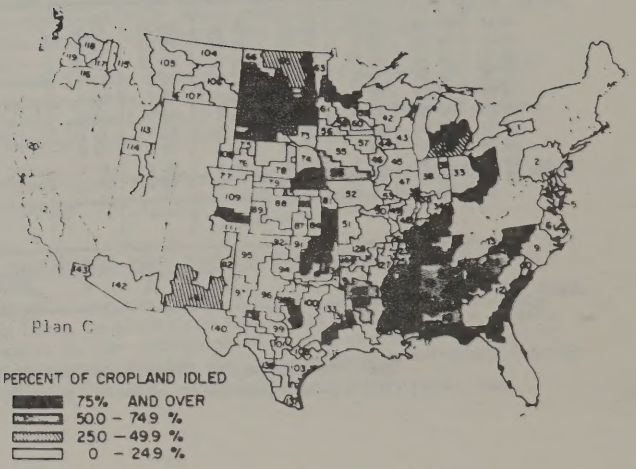


Plan E A feed grain program with trend level exports in 1980.

Plan F An acreage quota program with trend level exports in 1980.

Figure 8.--Location of idled cropland under four farm plans, 1980, continued.





Plan A A free market model 1965 level exports in 1980.

Plan C A free market without cotton quotas and with trend level exports in 1980.

Figure 8.--Location of idled cropland under four farm plans, 1980 (Source: Heady and Mayer, Food Needs)

The Heady-Mayer study shows that none of the three possible free market farm plans (A,B,C) would result in major crop prices as high as those of 1965 (Table 10). Hence, strong resistance to these alternatives can be expected. On the basis of price alone, Plan F with acreage quotas is the most attractive of the six practical plans considered.

Some idea of the subsidy involved can be obtained by comparing the free market prices (Plans A,B,C) with the controlled market prices (Plans E,F,G) in Table 10. The difference in these prices constitutes a tax on the consumers of farm products. The main justification of such a tax is that it prevents hardships to the owners and renters of farm land. Yet, even the lower prices of free market plans A,B,C would be offset by increased yields and lower costs. The result, as the Heady-Mayer study shows, would be an increase in net income or economic rent as shown in Table 11. These increased returns would tend to be bid up into higher land prices. For example, under Plan B in the Northeast, the net increase in annual rent of $10.21, if capitalized at 5 percent, would result in an increase in land values of $204 ($10.21 ÷ .05 = $204). In the mountain region, $11.85 would capitalize at $237 an acre and in the Pacific, $34.02 at $684. The increase in land values under the feed grain or acreage quotas of Plans F and G would be much higher. However, some of the returns might also be retained by farmers as a higher income for their management. In either case this study indicates that a decision to adopt a free market system would not result in farm incomes lower than present incomes. It would result in higher incomes but not so high as those provided by acreage quotas of Plans F and G.

Consuming Regions and Location of Production

Where should wheat, feed grains, soybeans and cotton be produced in the United States? To help answer this question Heady and Mayer combined the 48 States into 31 consuming regions. Some small States in the East and South were combined as were Idaho and Montana, Nevada and Utah, and Arizona and New Mexico in the West. The demand for wheat, feed grains, soybeans and cotton was then determined for each of these regions. Next, the least cost per bushel or pound was calculated for each of the 31 consumption regions. This cost included both variable production transportation costs as well as the higher land rent that might result from increased demand for cropland limited by nature or artifically by acreage quotas.

The resulting costs per bushel for wheat and feed grains are presented in Table 12 as prices that would have to be paid to meet expected consumer demand under the seven farm plans. Wheat prices show that demand relative to supply is the greatest in the northeastern and Pacific regions where the population will continue to be large and the supply of land suited for low cost wheat production will continue to

Table 11.--Estimated increase in economic rent under seven farm programs by regions, United States, 1980

Farm programs	A	B	C	D	E	F	G
United States			Dollars per acre				
Northeast	6.29	10.21	10.13	63.05	12.04	28.32	19.93
Lake States	3.19	5.16	5.00	59.42	5.52	24.52	20.02
Corn Belt	3.77	8.01	7.69	83.43	9.76	33.83	28.08
Northern Plains	2.51	4.31	3.94	46.52	7.33	22.22	11.83
Appalachian	2.31	5.84	2.93	59.71	8.41	28.62	23.75
Southeast	.08	.18	.18	51.77	.28	17.43	13.97
Delta States	1.31	4.55	2.70	57.78	6.88	25.77	20.34
Southern Plains	22.08	27.07	17.06	49.65	28.75	42.41	35.98
Mountain	7.28	11.85	11.25	68.26	8.93	23.98	12.17
Pacific	24.61	34.02	29.58	68.28	30.85	57.63	38.61

Source: Heady and Mayer, Food Needs, Tables 8, 12, 16, 20, 24, 28 and 32.

Table 12.--Wheat and feed grain prices required to secure production on the highest cost land needed to meet expected consumer demand in each region, present plan, 1965, and seven projected plans, 1980

Farm market plans	1965	A	B	C	D	E	F	G
	Wheat: dollars per bushel							
United States	1.34	1.11	1.27	1.27	4.40	1.49	1.92	1.17
Northeast	1.35	1.35	1.46	1.45	4.44	1.71	2.13	1.47
Lake States	1.43	.97	1.05	1.04	3.89	1.38	1.81	1.16
Corn Belt	1.35	.97	1.08	1.08	4.18	1.35	1.77	1.06
Northern Plains	1.36	.67	.78	.76	3.93	1.06	1.49	.74
Appalachian	1.38	1.32	1.46	1.45	4.46	1.73	2.16	1.45
Southeast	1.42	1.40	1.48	1.48	4.35	1.83	2.26	1.61
Delta States	1.29	1.37	1.49	1.47	4.54	1.79	2.22	1.45
Southern Plains	1.34	1.20	1.38	1.34	4.55	1.66	2.08	1.30
Mountain	1.26	1.04	1.16	1.15	4.18	1.15	1.57	.91
Pacific	1.34	1.13	1.34	1.32	4.39	1.16	1.59	1.00

Farm market plans	1965	A	B	C	D	E	F	G
	Feed grains: dollars per bushel							
United States	1.10	0.69	0.76	0.75	2.53	0.78	1.48	1.41
Northeast	1.30	.86	.90	.90	2.63	.95	1.63	1.57
Lake States	1.01	.57	.61	.61	2.42	.63	1.39	1.33
Corn Belt	1.08	.47	.52	.52	2.23	.54	1.22	1.16
Northern Plains	1.13	.55	.60	.59	2.40	.62	1.29	1.15
Appalachian	1.24	.83	.89	.89	2.61	.94	1.60	1.55
Southeast	1.24	.91	.93	.93	2.70	.95	1.70	1.65
Delta States	1.27	.86	.94	.94	2.65	.95	1.66	1.60
Southern Plains	1.25	.61	.66	.86	2.59	.67	1.34	1.24
Mountain	1.23	.83	.93	.91	2.81	1.08	1.77	1.61
Pacific	1.44	1.06	1.16	1.14	2.90	1.17	1.86	1.72

Source: Heady and Mayer, Food Needs, Tables 8, 12, 16, 20, 24, 28, and 32.

be scarce. Under all seven plans wheat can be most cheaply produced or provided in the Northern Great Plains and feed grains in the Corn Belt. The comparative advantage of these regions is most apparent under free market conditions. (Plans A, B, and C). Under the feed grains and acreage quota programs these differences are reduced (Plans E, F, and G).

The differences in prices actually paid to farmers in 1965 are also quite small because a national support price is set for each product supported and then State support prices are set on the basis of transportation costs to the nearest major market. Because the large differences in costs of production are ignored, there are only small price differences among the regions.

Conclusions

Up to 1980, Heady and Mayer conclude that for all models studied "except the maximum production model which was aimed at determining potential levels of crop output, there remained excess land resources after the level of demand was satisfied. In the past several years, this excess productive capacity has been controlled by retiring a substantial acreage of cropland from production. However, under these circumstances, society not only loses production gain from these acres, but also bears the expense of holding the land in idleness."[8]

After exploring the use of idle cropland for pasture in case of greatly increased per capita beef consumption by 1980, the authors conclude there would probably still be idle cropland in most regions amounting to a national total of from 37 to 39 million acres.

Can this situation be expected to hold to the year 2000? The next section will assess America's century-end food and fiber needs.

Can U.S. Agriculture Meet Food and Fiber Needs of Year 2000?

In the United States, there are 2,271 million acres of land. When the 369 million acres in Alaska and Hawaii are omitted, there remain 1,902 million acres in the contiguous 48 States of which 407 million acres are federal lands and 1,496 million acres are non-federal (mostly private) lands.[9]

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[8] Ibid., p. 89.

[9] U.S. Department of the Interior, Public Land Statistics, (Bureau of Land Management, 1967), Table 7.

According to a National Inventory of Soil and Water Conservation Needs made by the Soil Conservation Service, in 1958 there were 638 million acres of land suited to regular or annual cultivation, but only 373 million acres were actually in cropland. The balance consisted of 113 million acres in pasture and range, 125 million acres of forest and woodland, and 26 million acres of other land (Table 13). If all these 638 million acres were brought into production, the present 300 million acres of harvested cropland would be increased by 112 percent. This would be ample to meet the estimated medium high population increase of 75 percent by 2000 even if yields on the new lands were considerably less than present national averages. In addition, there are another 169 million acres that could be used for intermittent or occasional crop production. Thus a total of 807 million acres is considered suitable for regular or intermittent cultivation.

In view of the abundant supply of non-federal cropland, should the arable federal lands be disposed of for crop production? Under a free market for cropland the development of new land would tend to hold down farm produce prices and land values. But developing new lands when production controls are in use is difficult to justify since the two policies are generally contradictory. Yet it can be argued that developing new cropland in the Pacific region might be justifiable to help lower food costs there and thus restrain land prices. Perhaps the same end could be achieved more effectively, however, by simply adjusting or removing production controls for that region. Generally the maximum benefit to the general public is achieved when food and fiber are produced at least cost to meet the demands of the various regions. They will tend to be produced at least cost if acreage, production quotas or other barriers do not interfere and if production in high-cost areas is not encouraged by no-cost land (homesteads) and heavily subsidized irrigation development. Some of the comparative costs of developing new lands for crop production will be reviewed later in this report, but first the amount of federal lands suited for crop production will be examined.

The evidence indicates that the present large supply of land suitable for production--when combined with increasing yields and new food sources--will be able to meet food and fiber needs for the future. This was also the conclusion of the National Advisory Commission on Food and Fiber when it declared "the United States has no shortage of the natural resources needed to produce food and fiber. This does not mean that some regional shortages may not occur, but with intelligent use and flexibility in regional production patterns, there is no forseeable shortage."[10]

[10] Food & Fiber for the Future, National Advisory Commission on Food and Fiber, p. 243.

Table 13.--Non-federal, non-urban lands suitable for crop production in the 50 States, 1958

Present use	Lands suitable for crop production[a]		
	Regular use	Intermittent use	Total
	1,000 acres		
Cropland	373,328	48,993	422,321
Pasture and range	113,393	53,938	167,330
Forest and woodland	124,909	58,413	183,322
Other uses	26,380	7,838	34,218
Total	638,009	169,181	807,190

Source: United States Department of Agriculture, National Inventory of Soil and Water Conservation Needs, Soil Conservation Service, 1958, as published in Food & Fiber for the Future, p. 245.

IV. FEDERAL ARABLE LANDS: ARE THEY NEEDED FOR CROP PRODUCTION?

Amount of Arable Federal Lands

There are 371 million acres of federal public lands in the 17 Western States under administrative control of seven major federal agencies (Table 14). Much of this land is reserved for forests, and still more is used for grazing sheep and cattle. Some lands are parks and wildlife preserves, and others are utilized for defense activities. Much is mountainous and desert, presently unused by man to any extent.

This analysis is based only upon public lands that are arable--deemed suitable for intensive agriculture or crop production by federal agencies that now have administrative control. Estimates secured in a companion study (Volume IV) indicate that only 2.0 million of the 371 million acres of federal lands are suited for dryland crop production and that water is presently physically and legally available for only 1.3 million acres suited for irrigated crop production (Table 15). There are another 35 million acres that could be irrigated if water were available, but the prospect of these lands being brought into production by the year 2000 are so remote that they are not included in this analysis.

Lack of water seriously limits the amount of irrigation possible in the West. As urban population and industry increase they will outbid agriculture for available water supplies. It has been estimated that water for irrigated crop production is worth only ten cents per 1,000 gallons while in industries requiring water for processing, its value may exceed $5.00 per 1,000 gallons.[11] In addition, irrigation is a consumptive use of water. Very little of it returns to streams where it can be re-used. In contrast, most urban and industrial use is not consumptive. The water is returned to streams where it is available for re-use or waste dilution.

The pressure on water supplies in western water resource regions is indicated by the fact that 20 percent of the maximum sustainable flow is consumed as compared with only 1 percent in the eastern regions. Not only is there about one-third as much water in the West as in the East, but much more of it is used for crops. Of 64 million acre-feet consumed in the West, 60 million, or nearly 94 percent, were used up by irrigation.

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[11] C. P. Barnes, "Land Resource Potentials of the United States and World Regions," in Modern Land Policy, Land Economics Institute, University of Illinois (Urbana: University of Illinois Press, 1960), p. 80.

Table 14.--Federal public lands estimated suitable for dryland or irrigated crop production in 17 Western States, 1968, by agency

Agency	Federal lands held--total[a]	Federal lands--arable[b]		
		Dryland	Irrig.[c]	Irrig.[d]
	1,000 acres			
Bureau of Land Management	174,949	569	516	28,450
Forest Service	143,789	842	101	933
Bureau of Reclamation	9,012	23	424	371
National Park Service	12,854	21	5	696
Bureau of Sports, Fisheries and Wildlife	6,463	83	114	58
Department of Defense	17,351	344	151	4,550
Corps of Engineers	3,671	113	1	11
Agency not determined	3,211	0	0	0
Total acres	371,300	1,996	1,313	35,086
Land Utilization lands	6,591	510	115	536

[a] Public Land Statistics 1967, Tables 7 and 9.

[b] As reported by agencies. See Vol. IV of this report.

[c] Deemed irrigable with water physically and legally available.

[d] Deemed irrigable but water not now physically or legally available.

[e] Includes, land utilization project lands administered by the Bureau of Land Management and the Forest Service. These acres are included in their figures above. See H.H. Wooten, The Land Utilization Program 1934 to 1964, U.S. Department of Agriculture, ERS, Agr. Econ. Report 85, 1965, Tables 13-14.

Table 15.--Estimated acres of land suitable for farming as reported by seven federal agencies in 17 Western States, 1968

State	Federal land owned[a]	Federal land reported[b]	Dryland	Irrigable (water available)	Irrigable (water not available)
	- - Millions of acres - - -		- - - - - Thousands of acres - - - - - - - -		
Arizona	32.4	33.0	0	11	7,145
California	44.4	44.7	172	137	6,129
Colorado	24.0	23.0	103	88	298
Idaho	34.0	31.6	85	314	2,623
Kansas	.6	.6	99	43	0
Montana	27.6	26.9	279	6	13
Nebraska	.7	.6	10	5	26
Nevada	61.0	60.6	4	7	9,916
New Mexico	26.7	26.1	0	11	2,922
North Dakota	2.1	2.2	262	4	4
Oklahoma	1.4	1.2	44	3	45
Oregon	32.2	29.6	67	72	625
South Dakota	3.4	3.3	237	46	97
Texas	3.0	2.3	149	6	190
Utah	35.2	35.2	1	14	2,557
Washington	12.6	13.8	15	158	42
Wyoming	30.0	30.7	469	387	2,437
Totals	371.3	365.4	1,996	1,313	35,068

[a]From Public Land Statistics 1967, Table 7.

[b]Reported by seven federal agencies surveyed in 1968. See Vol. IV of this report.

While it may be physically possible to bring water to the West from the Columbia River or even the Yukon, the costs are prohibitive for agriculture and are likely to remain so for the forseeable future. When crops produced per 1,000 gallons are worth only a few cents, the water charge must be extremely low to make irrigated crop production profitable. Desalination of sea water may eventually ease the pressures on river and ground water in urban communities, but at present there seems little or no prospect that sea water can be utilized for irrigation.

Available Arable Federal Lands

It is assumed that arable lands held by the Forest Service, Department of Defense, National Parks, and Bureau of Sport Fisheries and Wildlife have high economic, political or social uses and will not be available for intensive crop production. Therefore this study is further limited to those lands that are under the control of the Bureau of Land Management, the Bureau of Reclamation, and the U.S. Army Corps of Engineers. These are believed to be the federal lands most likely to be brought into crop production in the next 30 years. They total only 705,000 acres suited for dryland crop production and 941,000 acres suited for irrigation for which water is presently available (Table 16). Most of the dryland acres are in Wyoming, Montana, North Dakota, and South Dakota. None of the other 13 States has over 200,000 acres and nine States have fewer than 100,000 acres. The average for each of the 17 States is only slightly more than 100,000 acres. Irrigable land with water available amounts to 387,000 acres in Wyoming and 314,000 acres in Idaho. Washington has the next largest amount with 158,000 acres, and California has 137,000 acres. None of the other States has as much as 100,000 acres, and 10 States have less than 50,000 acres each.

These lands, if used for crop production, would increase dryland harvested cropland in the 17 Western States by less than 1 percent and irrigated harvested cropland by only 3 percent (Table 17). In only five States would the dryland be increased by more than 1 percent, and in only six States would irrigated land be increased by more than 1 percent. Wyoming would have by far the largest increase, 34 percent in dryland and 35 percent in irrigated acreage. Idaho would have a 5 percent increase in dryland with a 14 percent increase in irrigated land, and Washington and Colorado would have 11 and 3 percent increases in irrigated land, respectively.

The number of new farms that might be created from these federal lands is quite small. If $5,000 were considered an adequate annual return to the farmer for his labor and management, then 1,200 acres of dryland crops or 300 acres of irrigated crops would be needed in

Table 16.--Federal public lands suited for crop production held by three federal agencies in 17 Western States, 1968

	Bureau of Reclamation		Bureau of Land Mg't		Corps of Engrs.		Total	
	Dryland	Irrigated	Dryland	Irrigated	Dryland	Irrigated	Dryland	Irrigated
	1,000 acres							
Arizona	0	6	0	0	0	0	0	6
California	4	20	0	0	0	0	4	20
Colorado	2	13	101	72	0	0	103	86
Idaho	0	146	83	160	0	0	83	306
Kansas	2	0	0	0	24	0	26	0
Montana	12	5	88	0	5	0	105	5
Nebraska	1	1	0	0	0	0	1	1
Nevada	0	2	0	0	0	0	0	2
New Mexico	0	0	0	0	0	0	0	0
North Dakota	0	0	4	0	18	0	22	0
Oklahoma	0	0	1	0	1	0	3	0
Oregon	1	23	59	0	0	0	60	23
South Dakota	0	0	30	0	1	0	31	0
Texas	0	0	0	0	61	0	61	0
Utah	0	1	0	0	0	0	0	1
Washington	1	103	0	0	2	1	3	104
Wyoming	0	102	203	284	0	0	203	387
Totals	23	423	569	516	113	1	705	941

Source: Estimates provided by these three agencies, 1968. See Vol. IV of this report.

Table 17.--Private cropland harvested and arable federal lands held by Bureau of Land Management, Bureau of Reclamation and Corps of Engineers in 17 Western States

State	Private cropland harvested[a]			Federal arable public lands[b]			
	Total	Dryland	Irrigated	Dryland	Irrigated[c]	Dryland increase	Irrigated increase
	1,000 acres					Percent	
Arizona	1,025	20	1,005	0.0	6.0	0	*
California	7,846	1,409	6,437	4.1	20.3	*	*
Colorado	4,726	2,682	2,044	103.4	85.9	4	3
Idaho	3,935	1,696	2,239	83.0	306.3	5	14
Kansas	18,160	17,312	848	26.2	0.0	*	0
Montana	7,813	6,433	1,380	104.9	5.2	2	*
Nebraska	15,229	13,167	2,062	0.7	1.0	*	*
Nevada	507	4	503	0.0	2.5	0	1
New Mexico	906	218	688	0.0	0.0	0	0
North Dakota	17,695	17,646	49	22.3	0.0	*	0
Oklahoma	8,344	8,084	260	2.5	0.0	*	0
Oregon	3,050	1,964	1,086	59.6	22.5	3	2
South Dakota	14,445	13,310	1,135	31.0	0.0	*	0
Texas	19,408	13,509	5,899	61.0	0.0	*	0
Utah	1,039	270	769	0.0	1.1	0	*
Washington	4,423	3,514	909	3.3	103.8	*	11
Wyoming	1,702	598	1,104	203.1	386.6	34	35
Total	130,243	101,836	28,444	705.2	941.2	1	3

[a] 1964 U.S. Census of Agriculture, Vol. 2, Chap. 3, pp. 248-49. [b] From Table 18 or Volume IV of this report. [c] Water available. * Less than 0.5 percent.

most areas of the West. Thus the 705,000 acres deemed suitable for dryland farming would create fewer than 600 new dryland farms, and the 941,000 acres suited for irrigation would create perhaps another 3,100 irrigated farms in the 17 Western States.

Even these estimates may be high. Much of this land is in small tracts scattered along streams that are often in mountainous areas difficult to reach and far from public services considered essential for modern living. It seems probable that they would eventually be used by ranchers for hay and winter feeds or to enlarge other farms that are too small to provide a satisfactory living.

Probable Contribution of Federal Public Lands to Food and Fiber Needs

The contribution of arable federal lands to future food and fiber needs depends not only upon their acreage but also upon potential crops and their yields. This analysis assumes that dryland crops grown and the acres of each crop will be approximately the same as planted acres of the major crops in the 11 Western States. These States were used because the eastern portions of the Great Plains are not typical of the areas where most of the federal arable lands are located. It is also assumed that irrigated crops grown and the acres of these crops would closely approximate the pattern of irrigated crops in the 17 Western States as shown in Figure 9. Most of this irrigated cropland is in areas like those of the arable federal lands suited for irrigation. Finally, it is assumed that the yields of these crops will approximate average yields in the nation.

With these assumptions Table 18 was prepared. It indicates that arable federal lands would increase the nation's 300 million acres of harvested cropland only slightly more than 0.5 percent (rounded to 1 percent). The increases by crops are also shown. Only barley and sugar beets would increase by more than 1 percent under these assumptions. Since any rise in yields by 1980 or 2000 would probably affect the new lands as much as the old, the percentage contribution of new lands to food and fiber needs would not change.

The probable effect of arable federal lands on crops produced in each of the 11 Western States with such lands are shown in Appendix A Tables 1-11. These tables are included to illustrate the small acreage changes that would occur if these lands were developed. They are not predictions of crops that might be grown.

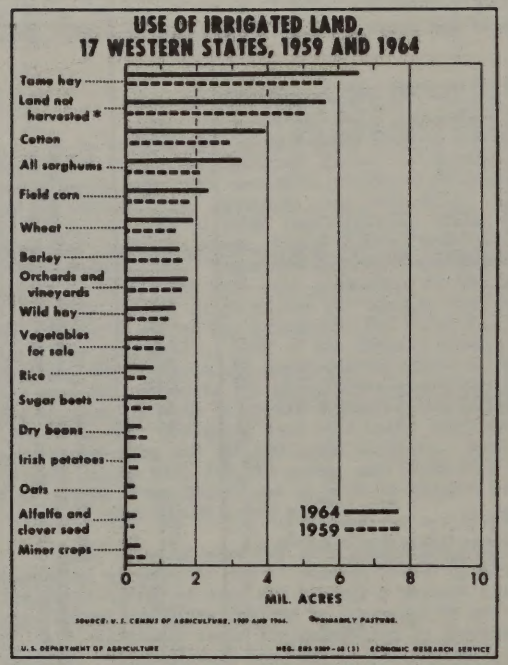

Figure 9

Table 18.--Estimated effect of federal public lands suitable for crop production on total acres of cropland, by crop

Crops	Harvested cropland[a]	Estimated use of arable public lands			
		Dryland	Irrigated	Total	Increase
	1,000 acres				percent
Total	300,446	705	941	1,646	1
Corn, grain	60,557	14	65	79	*
Wheat, all	58,771	197	56	253	*
Oats	16,017	21	19	40	*
Soybeans (beans)	39,767	0	0	0	0
Barley	9,177	99	47	146	2
Minor grains	5,000	0	19	19	1
Sorghums	16,000	127	94	221	1
Cotton	13,400	0	112	112	1
Hay, all	66,800	225	404	629	1
Beans, dry	1,428	0	19	19	*
Potatoes	1,358	0	19	19	1
Sugar beets	1,228	0	38	38	3
Vegetables, fresh	1,638	0	18	18	1
Vegetables, other	1,675	0	20	20	1
All other	12,630	1	11	12	*

[a]1967 data for the 48 contiguous States from Crop Production, 1968 Annual Summary by States, U.S. Department of Agriculture (Statistical Reporting Service, 19 December 1968), p. 3.

[b]Total arable federal lands divided by harvested cropland, 48 States.

* Less than 0.5 percent.

V. SOME COSTS OF DEVELOPING LANDS FOR DRY AND IRRIGATED CROP PRODUCTION

The National Advisory Commission on Food and Fiber has declared that "reclamation and land development projects paid for by public investment have significantly increased farm production in the past three decades, during which agriculture was plagued with overproduction and surpluses. Clearly it is unsound policy to invest public funds in new farm capacity at a time when the overriding problem is too much capacity." Therefore "the Commission recommends that public funds for agricultural reclamation, irrigation, drainage and development projects should be justified on the basis of whether they represent the cheapest means of getting additional farm production--if needed."[12]

In deciding whether public funds would be the cheapest way to get additional production, the Advisory Commission declared that "all land should be considered as a possibility for expanding output and the cost of transforming the land should be weighed against the cost of putting idle acres back into use." At the present time, over 60 million acres of cropland are idle (Table 19). Since the Heady-Mayer study indicates that 35 million acres or more will still be idle in 1980 despite a 26 percent increase in population and a sharp increase in consumption rates, it appears that the excess capacity problem is certain to persist well beyond that date.

The fact that the government is currently paying farmers, either directly or indirectly, to keep these 60 million acres idle makes it quite clear that returning them to production would result in substantial savings of public funds--a sharp contrast to transforming land through federal irrigation projects whose costs often exceed $1,000 an acre. In 1959 the Bureau of Reclamation estimated the average cost of developing 9.5 million acres of new irrigated land (or its equivalent in old cropland) at $921 an acre (Table 20). In the south Pacific region the estimate was $2,780 an acre, and for the other regions it ranged from $600 to $1,400.

The Bureau of Reclamation also estimated non-federal costs of developing 2.7 million acres of irrigated land in the Western States (Table 20). The average was estimated to be $313 an acre with a range from $140 to $659.

[12]Food & Fiber for the Future, National Advisory Commission on Food and Fiber (italics in original), p. 21.

Table 19.--Land diverted from crop production by government production or conservation programs, 1956-1966

Year	Acreage Reserve	Conservation Reserve	Feed Grain	Wheat	Cotton	Cropland Conversion	Cropland Adjustments	Total†
			(million acres)					
1956	12.2	1.4	...	...	..	..	..	13.6
1957	21.4	6.4	...	...	..	..	..	27.8
1958	17.2	9.9	...	...	..	..	..	27.1
1959	...	22.5	...	...	..	..	..	22.5
1960	...	28.7	...	...	..	..	..	28.7
1961	...	28.5	25.2	...	..	..	..	53.7
1962	...	25.8	28.2	10.7	..	..	..	64.7
1963	...	24.3	24.5	7.2	..	0.1	..	56.1
1964	...	17.4	32.4	5.1	0.5‡	0.1	..	55.5
1965	...	14.0	34.8	7.2	1.0‡	0.4	..	57.4
1966§	...	13.3	32.0	8.2	4.7	0.4	2.0	60.6

• Source: USDA.
† Total diverted including acreage devoted to substitute crops.
‡ Not required to be put to conserving uses.
§ Except for conservation reserve, represents enrolled acreage Agr. Stab. and Conserv. Ser., USDA, *Agricultural Statistics 1966*, GPO, p. 541.

Source: Food Goals, Future Structural Changes, and Agricultural Policy: A National Basebook (Ames: Iowa State University Press, 1969), p. 307.

Table 20.--Irrigation development costs per equivalent acre as estimated by Bureau of Reclamation, 1959

Water resource region	New land equivalent[a]		Cost equivalent new land	
	Federal	Non-federal	Federal	Non-federal
	- - - 1,000 acres - - -		- - Dollars per acre - -	
Upper Rio Grande and Pecos	165	- - -	$ 750	$ - - -
Upper Missouri	2,740	603	1,160	200
Upper Arkansas and Red	174	731	1,167	207
Lower Arkansas Red-White	52	- - -	566	- - -
Western Gulf	796	88	730	659
Colorado	1,200	69	1,374	140
Great Basin	260	299	906	251
Pacific Northwest	2,650	802	646	484
Central Pacific	1,445	84	681	384
South Pacific	18	24	2,780	425
TOTALS	9,500	2,700	$ 921	$ 313

Source: U.S., Congress, Senate, Select Committee on National Water Resources, Future Needs for Reclamation in the Western States: Water Resources Activities in the United States, 86th Congress, 2nd Session, 1960, Committee Print 14, Table 11, p. 19.

[a]Includes not only new, previously uncultivated irrigated lands but also allows for any previously cultivated lands scheduled to receive some water.

The initial stage of the Oahe Unit of the Missouri Basin Project has just been authorized. The initial stage calls for the irrigation of 190,000 acres of land with total allocated costs of $25.8 million or $1,083 an acre. By charging some of these costs to main-stem storage and power the cost is reduced to $881 an acre. Of this amount the landowner is expected to pay only 15 percent and Missouri River Basin power revenues, 84 percent. Thus this project involves a subsidy of $740 to $910 an acre, the amount depending on cost allocation.[13]

While the necessity of subsidizing 84 percent of the cost of irrigation development clearly indicates that such development is not economic, the Bureau of Reclamation was still able to show direct benefits of $1.60 for each $1.00 spent. The Bureau explains as follows: "Direct irrigation benefits result from the increase in net farm income with the application of water. These benefits include increases in family living and in accumulation of equity in the farm investment."[14] Quite obviously such benefits involve double counting of net income--once when it is received and again when it is spent to improve family living or pay off debts. These and other weaknesses of the benefit-cost analyses of the Bureau of Reclamation have been pointed out by several economists including Douglas and Renshaw.[15] (Renshaw's article cited below is reproduced in Appendix B.)

Fortunately there are 113 million acres of pasture and range, 125 million acres of forest and woodland, and 26 million acres of other land that can be used for regular or annual crop production (Table 13). Moreover, there are another 169 million acres that can be used from time to time, and much of this acreage is in more humid areas of the United States where irrigation is not necessary.

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[13] U. S., Congress, House, Oahe Unit, Missouri River Basin Project, South Dakota: Report on the Initial Stage of the Oahe Unit . . ., 90th Congress, 1st Session, 1967, House Document 163, Table 2, pp. 46-50.

[14] Ibid., p. 41.

[15] Edward F. Renshaw, "Appraisal of Federal Investment in Water Resources" in Modern Land Policy, Papers of the Land Economics Institute, University of Illinois (Urbana: University of Illinois Press, 1960), Paper 17; and Paul H. Douglas, Why the Upper Colorado River Project is Against the Public Interest, Remarks in U.S. Senate, 18 April 1955 (Washington, D.C.: U.S. Government Printing Office, 1955).

How does the cost of clearing and draining land compare with the Bureau of Reclamation's 1959 estimates of irrigation costs? A general survey of land clearing and draining costs was made by Wooten and Purcell in 1949.[16] They found that there were many millions of acres of land that could be developed for farming by clearing and draining and cited the following costs per acre:

Kind of work	Cost in dollars per acre
1. South	
Draining undeveloped land in drainage districts	$ 5 - $ 30
Clearing costs (stumps remain)	$25
Clearing costs (stumps removed)	$50 - $ 75
2. Northeast	
Brush cleared for seeded pasture	$50 - $110
Brush cleared for cultivated crops	$95 - $160
Light brush cleared from abandoned fields	$15 - $ 30
Clearing of brush and stone	$50 - $100
Clearing for drainage	$30 - $125
3. Southeast	
Custom clearing, group basis	$36 - $ 50
Clearing small trees and brush	$25
Clearing, stumping and draining	$60 - $ 75
Clearing or drainage	$40 - $ 55

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[16] H. H. Wooten and Margaret R. Purcell, Farm Land Development: Present and Future by Clearing, Drainage and Irrigation, U.S. Department of Agriculture Circular 825 (1949).

	Cost in dollars per acre
4. Mississippi River Delta	
Clearing land	$30 - $100
Buying and clearing land	$65
Cost of land and clearing	$60 - $100
5. Northwest	
Easy clearing	$18 - $ 39
Medium clearing	$57
Difficult clearing	$80
Clearing heavy timber and stumps	up to $200

No doubt some of these lands have been brought into production during the past 20 years. It also seems likely that those most cheaply cleared or drained may have been the first developed. Hence, future costs will be higher not only because of inflation but also because lands remaining will be more difficult and more expensive to clear and drain. Even so, the figures suggest that millions of acres of uncleared and undrained lands could be brought under cultivation for well under $200 an acre.

Whether or not it is economical to clear and drain these lands is certainly another question. The fact that over 60 million acres of croplands have been retired from production under various governmental programs indicates that such development even at these low costs would not result in "maximum benefit for the general public" at this time. However, by the year 2000 these lands may be needed. If so, demands for food will tend to result in higher farm prices and provide incentive for developing them.

VI. SUMMARY AND CONCLUSIONS

Can U.S. agriculture meet the food and fiber needs of 1980 and 2000? What contribution can arable federal lands make that is consistent with "maximum benefit to the general public"? The purpose of this paper was to help answer these questions by a review and analysis of the situation which appears to be as follows:

1. While world population is expected to double by the year 2000 and thus create unprecedented demands for food, demands in the underdeveloped countries must be met, except in time of drought or diaster, by local production.

2. The U.S. contribution to food and fiber needs of other countries will be maximized by providing fetilizers, insecticides and other chemicals, seeds, tools and technical help rather than food.

3. The demand for U.S. agricultural production will continue to be largely limited to the needs of the domestic population and the developed countries that find it profitable to import our foods, feeds, and fibers.

4. The U.S. population is expected to increase about 25 percent by 1980 and 75 percent by 2000.

5. A study made for the National Advisory Commission on Food and Fiber by Professors Earl Heady and Leo Mayer of Iowa State University indicates that, despite expected rises in population and foreign demand, the increase in yields and efficiency will be so great that no more than 20 million of the 60 million acres of idle cropland will be called back into production by 1980.

6. A survey by the Soil Conservation Service indicates that out of the 638 million acres of land suited for regular crop production in the United States in 1958, 373 million acres were in cropland. Currently only 300 million acres of cropland are being harvested, and 60 million acres have been retired from production by government programs.

7. Even if there were little or no increase in yields and technology, U.S. food and fiber needs of the year 2000 could be easily met by increasing crop acreage from 300 million to 600 million.

8. Of the 371 million acres of federal public lands, only 3.3 million acres are deemed arable or suitable for crop production by the seven federal agencies that now administer these lands; only 705,000 acres suited for dryland crop production and 941,000 acres suited for irrigation are likely to be available. These are lands held by the Bureau of Land Management, Bureau of Reclamation and the Corps of Engineers. The contribution of these 1.6 million acres of federal lands to food and fiber production needs would be very small indeed.

9. The Bureau of Reclamation estimated the cost of future federal irrigation projects at $921 an acre and non-federal projects at $313 an acre. Both these costs far exceed clearing and draining costs for millions of acres of land in humid areas of the United States. The latter would seldom exceed $200 an acre.

10. The evidence indicates that U.S. agriculture can easily meet food and fiber needs for both 1980 and 2000 without the use of the 1.6 million acres of federal lands considered suitable and available for crop production.

APPENDIX A

Table A 1.-- Arizona: Estimated probable use of federal public lands suited for crop production in the Western States

State	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	800,000	100	6,000
Corn, all	32,000	4	240
Oats	*	*	*
Barley	187,000	23	1,380
Sorghum, all	254,000	32	1,920
Wheat, all	55,000	7	420
Rye	*	*	*
Rice	*	*	*
Cotton	248,000	31	1,860
Potatoes	11,000	1	60
Beans Dry	*	*	*
Peas	*	*	*
Sugar Beets	13,000	2	120

* Less than .05 percent

Table A 2.--California: Estimated probable use of federal public lands suited for crop production in the Western States

State	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	4,647,000	100	24,400
Corn, all	326,000	7	1,708
Oats	393,000	8	1,952
Barley	1,618,000	35	8,540
Sorghum, all	451,000	10	2,440
Wheat, all	383,000	8	1,952
Rye	*	*	*
Rice	362,000	8	1,952
Cotton	595,000	13	3,172
Potatoes	110,000	2	488
Beans Dry	189,000	4	976
Peas	*	*	*
Sugar Beets	220,000	5	1,220

* Less than .05 percent

Table A 3.--Colorado: Estimated probable use of federal public lands suited for crop production in the Western States

State	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	5,332,000	100	189,300
Corn, all	501,000	9	17,037
Oats	114,000	2	3,786
Barley	279,000	5	9,465
Sorghum, all	659,000	12	22,716
Wheat, all	3,349,000	63	119,259
Rye	63,000	1	1,893
Rice	*	*	*
Cotton	*	*	*
Potatoes	47,000	1	1,893
Beans Dry	184,000	4	7,572
Peas	*	*	*
Sugar Beets	136,000	3	5,679

* Less than .05 percent

Table A 4.--Idaho: Estimated probable use of federal public lands suited for crop production in the Western States

State	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	2,770,000	100	389,300
Corn, all	82,000	3	11,679
Oats	73,000	2	7,786
Barley	542,000	20	77,860
Sorghum, all	*	*	*
Wheat, all	1,398,000	50	194,650
Rye	16,000	1	3,893
Rice	*	*	*
Cotton	*	*	*
Potatoes	307,000	11	42,823
Beans Dry	92,000	3	11,679
Peas	102,000	4	15,572
Sugar Beets	158,000	6	23,358

* Less than .05 percent

Table A 5.--Montana: Estimated probable use of federal public lands suited for crop production in the Western States

State	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	6,546,000	100	110,100
Corn, all	70,000	1	1,101
Oats	244,000	4	4,404
Barley	1,319,000	20	22,020
Sorghum, all	*	*	*
Wheat, all	4,825,000	74	81,474
Rye	12,000	*	*
Rice	*	*	*
Cotton	*	*	*
Potatoes	8,000	*	*
Beans Dry	8,000	*	*
Peas	*	*	*
Sugar Beets	60,000	1	1,101

* Less than .05 percent

Table A 6.--Nevada: Estimated probable use of federal public lands suited for crop production in the Western States

State	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	55,000	100	2,500
Corn, all	6,000	11	275
Oats	10,000	18	450
Barley	19,000	35	875
Sorghum, all	*	*	*
Wheat, all	19,000	35	875
Rye	*	*	*
Rice	*	*	*
Cotton	*	*	*
Potatoes	1,000	1	25
Beans Dry	*	*	*
Peas	*	*	*
Sugar Beets	*	*	*

* Less than .05 percent

Table A 7.--New Mexico: Estimated probable use of federal public lands suited for crop production in the Western States

State	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	1,011,000	100	0
Corn, all	45,000	5	0
Oats	*	*	0
Barley	30,000	3	0
Sorghum, all	424,000	42	0
Wheat, all	372,000	37	0
Rye	*	*	0
Rice	*	*	0
Cotton	132,000	13	0
Potatoes	3,000	*	0
Beans Dry	5,000	*	0
Peas	**	*	0
Sugar Beets	*	*	0

* Less than .05 percent

Table A 8.--Oregon: Estimated probable use of federal public lands suited for crop production in the Western States

State	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	1,744,000	100	82,100
Corn, all	36,000	2	1,642
Oats	155,000	9	7,389
Barley	298,000	17	13,957
Sorghum, all	*	*	*
Wheat, all	1,080,000	62	50,902
Rye	95,000	5	4,105
Rice	*	*	*
Cotton	*	*	*
Potatoes	50,000	3	2,463
Beans Dry	*	*	*
Peas	10,000	1	821
Sugar Beets	20,000	1	821

* Less than .05 percent

Table A 9.--Utah: Estimated probable use of federal public lands suited for crop production in the Western States

State	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	537,000	100	1,100
Corn, all	46,000	9	99
Oats	30,000	5	55
Barley	130,000	24	264
Sorghum, all	*	*	*
Wheat, all	288,000	54	594
Rye	*	*	*
Rice	*	*	*
Cotton	*	*	*
Potatoes	8,000	1	11
Beans Dry	9,000	2	22
Peas	*	*	*
Sugar Beets	26,000	5	55

* Less than .05 percent

Table A 10.--Washington: Estimated probable use of federal public lands suited for crop production in the Western States

States	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	3,648,000	100	107,100
Corn, all	54,000	1	1,071
Oats	61,000	2	2,142
Barley	235,000	6	6,426
Sorghum, all	*	*	*
Wheat, all	3,002,000	82	87,822
Rye	52,000	1	1,071
Rice	*	*	*
Cotton	*	*	*
Potatoes	64,000	2	2,142
Beans Dry	9,000	*	*
Peas	121,000	3	3,213
Sugar Beets	50,000	1	1,071

* Less than .05 percent

Table A 11.--Wyoming: Estimated probable use of federal public lands suited for crop production in the Western States

States	Planted cropland non-federal lands		Arable federal land
	Acres	Percent	Acres
Total	758,000	100	589,700
Corn, all	56,000	7	41,279
Oats	118,000	16	94,352
Barley	111,000	15	88,455
Sorghum, all	*	*	*
Wheat, all	351,000	46	271,262
Rye	27,000	4	23,588
Rice	*	*	*
Cotton	*	*	*
Potatoes	3,000	*	*
Beans Dry	38,000	5	29,485
Peas	*	*	*
Sugar Beets	54,000	7	41,279

* Less than .05 percent

APPENDIX B

Appraisal of Federal Investment in Water Resources

EDWARD F. RENSHAW *

Over the decades since 1900, appropriations by the federal government for the development of water resources have increased substantially. As of 1954, appropriations from 1900 to 1954 were estimated to have amounted to 14.3 billion dollars. Expenditures by the major project-building agencies for the fiscal year, 1958, are expected to be in excess of 850 million dollars, a moderate increase over 1957, and an increase of over 150 million dollars compared with 1956. Given the magnitude of federal expenditures, the general tightness of the budgetary situation, and the necessity of making dramatic changes in appropriations in order to maintain our national defense, to prepare ourselves for the age of missiles and space exploration, and to lay the foundation for an era of unparalleled scientific and technical competition on an international level, scrutiny of expenditure policies in the area of water resource development is entirely apropos. Do expenditures in this area, by the federal government, represent the best use to which a limited amount of funds can be put? Can the transfer of resources from the private sector of our economy to the public sector be truly justified in the sense that benefits exceed costs? These are but a few of the difficult questions that must be asked as Congress reviews the demands which have been placed on the budget and attempts to ration funds among competing proposals.

The need for an economic appraisal of federal investment in water resource development programs rests essentially on the extent to which these

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investments are subsidized by the general taxpayer as opposed to comparable investments made elsewhere in our economy. The extent of the subsidy ranges from about 40 per cent, in the case of public power, to nearly 100 per cent, in the case of navigation, flood control, and basin-wide irrigation. Since the benefits that accrue from public investment are more localized than the tax base that supports expenditures, the direct return from a particular project need not be as great as could be obtained by investing the same funds elsewhere in the economy in order to make a public project appear justified from a purely local point of view. On the basis of logic alone, one would anticipate that local groups would bring pressure to bear upon Congress and the agencies involved in water resource development to construct local projects which would not be in the best interest of the nation as a whole.

An attempt has been made by the author to subject contemporary federal investment to a test that was largely independent of the elaborate procedures used by the various agencies to justify project construction.[1] Attention was focused on four major aspects of water resource development: reclamation, navigation, flood control, and power. The results of the overall analysis of these aspects of resource development suggested that a large part of contemporary investment cannot truly be justified in terms of expected benefits exceeding the opportunity cost of development. The need for a fundamental reappraisal of financial responsibility on the part of the federal government in this area was emphasized.

In this paper, an attempt is made to extend the analysis in two ways. First, an endeavor is made to establish a theoretical framework from which one can view contemporary benefit-cost analysis within an economic context. Second, an attempt is made to analyze the bias inherent in the estimating procedures of one specific water resource agency, the Bureau of Reclamation, and thus demonstrate the way in which submarginal projects are "justified" to be in the public interest. The latter analysis is meant to be illustrative of biased estimating procedures rather than a specific criticism of the Bureau, since the various agencies are equally guilty with respect to the practice of presenting biased estimates to justify project construction.

ECONOMIC AND THEORETICAL FRAMEWORK FOR BENEFIT-COST ANALYSIS

In recent years increasing attention has been paid to the way in which the various federal agencies allocate resources for public improvements. The rather large body of independent procedures established by law and administrative edict to aid in the selection of investment alternatives has been subjected to searching criticism both within and outside the government.

It has been suggested that the evaluations (commonly referred to as benefit-cost analyses) of water resource projects, by all agencies, "be put

[1] Edward F. Renshaw, *Toward Responsible Government* (Chicago: Idyia Press, 1957).

on a uniform basis, requiring balanced consideration of all benefits and costs which can reasonably be measured in dollars, as well as consideration of other values not readily expressed in monetary terms."[2] In light of this suggestion, the Federal Inter-Agency River Basin Committee is currently revising *Proposed Practices for Economic Analysis of River Basin Projects*, referred to hereafter as the *Green Book*.

A purpose of this paper is to establish a correspondence between "proposed practices" and established economic theory. Attention is focused on the object of benefit-cost analysis or benefit measurement and on the budgeting of project resources and costs.

To make the notions underlying contemporary benefit-cost analysis completely general and to make them correspond to established economic theory, benefit-cost analysis is assumed to have the objective of maximization of the "social welfare" over time.[3] The welfare to be maximized corresponds to increments in consumer and producer surplus[4] unobtainable without public action.

From an allocative point of view the surplus is regarded as a return to public action. The returns are generally distributed in three directions: (1) to political factors of production either in the form of compensations directly associated with the office itself or compensations derived indirectly from those who benefit from public action; (2) to nonpolitical factors of production with inelastic supply schedules which have their prices bid higher than would have been the case without public action; and (3) to consumers in the form of lower prices paid for goods consumed than would otherwise prevail.

In order to arrive at a net surplus (benefit) for any specific project, one must deduct from gross surplus the value of the alternative product that

[2] Presidential Advisory Committee on Water Resources Policy, *Water Resources Policy* (Washington: GPO, 1956), p. 12.

[3] If the benefit-cost ratio is used as a maximizing tool, alternative assumptions as to what is being maximized can lead to a marked instability in the computed ratio, depending on the extent to which associated costs are netted out of gross benefits before the ratio is computed. Since benefit-cost ratios are also subject to relevant variation due to differences in product demand, underlying production functions, and factor supply prices, this author is inclined to reject their use as an indicator of either project priority or social goodness. The correct criterion for choosing among projects, assuming all resources have been properly valued or costed, is to select those projects with the largest surplus of benefits over costs. An advantage of this criterion is that it will lead to consistent results in many cases even though the object of maximization is assumed to be different; i.e., it makes no difference whether the object of maximization is the return to water as a scarce resource put to its highest alternative uses, the return to all resources used by the project, the social return associated with investing capital on public account, or what I choose to call, in this paper, the "social welfare."

If public capital is rationed such that not all mutually exclusive projects with benefit-cost ratios in excess of unity can be undertaken, it may be necessary to substitute into the fixed budget various alternatives until one is convinced that the aggregate return to the entire budget is maximized.

[4] For a discussion of consumer and producer surplus, see Alfred Marshall, *Principles of Economics*, 8th ed. (New York: Macmillan Company, 1952), p. 811.

could have been produced if resources had not been diverted to the production of project output.

Benefit Measurement

Any attempt to measure the social surplus or benefits resulting from a project[5] contains an assumption that for every good or service produced there exists both a *demand* relationship and a *supply* relationship which are independent of each other and independent of the acceptance or rejection of project alternatives.

The demand for the output of a proposed project is an excess demand derived by subtracting the supply schedule that would exist without the project from aggregate demands. The social surplus or benefit has been defined as the maximum amount consumers would be willing to pay for alternative outputs given the all-or-none proposition of consuming each output separately or of forgoing consumption of project output entirely.

If the criterion for benefit estimation is a willingness to pay either individually or collectively for benefits received, then the notion of a benefit corresponding to social surplus by definition contains every conceivable benefit associated with project output. Additional benefits should not be claimed unless there is associated with the output under consideration a joint product with a positive excess demand which would be forgone without public investment.[6]

The only kind of excess demand curve from which it makes sense to estimate the benefits from project investment, is an excess demand computed from demand and supply schedules that would exist in the absence of government intervention on behalf of pricing policies. Obviously if production is being restrained in order to maintain a higher market price than would otherwise prevail, it would be inappropriate to value public output at the supported price, since any surplus associated with a price reduction to the free market equilibrium level could be obtained without cost by merely removing the restraint on production. The reverse argument holds for prices that are being held below free market equilibrium levels since consumers value incremental output at a much higher price than they are permitted to pay.

[5] Unless the income-generating effects of a project are large in relation to total income and/or the income elasticity of demand for project output high, a partial equilibrium analysis of aggregate demand will yield an estimate of the social surplus sufficiently close to the general equilibrium case that income-generating effects of the project can be ignored. From the standpoint of the nation as a whole, the income-generating effects of any one water resource project are bound to be so small as to only imperceptibly influence aggregate demand.

[6] If the notion of secondary or indirect benefits, which has recently crept into the project analysis of the Bureau of Reclamation, makes sense, it must refer either to consumer surplus stemming from lower product prices, to producer surplus stemming from higher factor prices than would otherwise exist, or to the production of joint products in excess demand. From the point of view of the analysis in this paper, all of these benefits are primary and should be regarded as such in project analysis.

The same line of reasoning holds with respect to marginal taxes. If marginal taxes on output or on some necessary factor of production such as capital are not to be treated as costs, then the only relevant excess project demand would be a curve computed from demand and supply schedules existing in the absence of federal excise taxes.

Neither the social surplus lost because of the tax nor the value of the excise tax should be counted as net project benefits since such benefits could be obtained by altering the tax structure, without the aid of project investment.

Estimating Project Demand

Excess (project) demand is defined by the prices prevailing when alternative quantities of project output are added to the amounts others supply. If the maximum price consumers are willing to pay for any amount of project output is the price prevailing in the market without the project, then the prevailing market price imposes an upper limit on the true project demand function.

If project output is so small as to only imperceptibly affect market price, we can assume a perfectly elastic demand for project output. An exact measure of the social benefit from public output is obtained by multiplying expected output by the expected market price at which the project output is sold. This procedure for estimating benefits corresponds, in general, to actual practices of the various agencies, where goods and services produced have market values.

If the project output is so large as to perceptibly affect the market price, an allowance must be made for the fact that consumers place a smaller value on successive units of output. Assuming that the excess demand for project output is linear, an exact measure of the social benefits, corresponding to the area under the demand curve, is obtained by averaging the market prices that would prevail both with and without the project and by multiplying this average price by the expected output. This procedure for estimating benefits corresponds to what is recommended in the *Green Book*.[7]

The analysis of benefits stemming from products for which there exists no perfect substitute in the market poses difficulties.[8] Conceptually the procedure for estimating benefits is the same. The problem of course is that

[7] In general, the various agencies make no allowances for a fall in prices resulting from large project outputs. This is true even with respect to inland waterway investment where a large part of the benefits from navigation are assumed to accrue from traffic which does not flow because of prohibitive freight rates. The proposed Hell's Canyon dam represents an excellent example of a case where the benefits from a large increment in power were analyzed without taking into account the possibility of a downward sloping demand.

The Missouri River Basin Project represents a case in which a 75 per cent increase in sugar beet production was postulated without taking into account either demand effects or artificial restraints imposed upon supply to maintain sugar prices.

[8] Such benefits are often discussed in the literature as intangibles and as extra market values.

market data cannot be used in estimating the excess project demand unless one is prepared to assume that the true parameters governing aggregate demand bear close relationship to parameter estimates for close substitutes.[9]

Some hope exists for being able to estimate the aggregate demand for certain nonmarketable outputs[10] in terms of marginal output expenditures by local and state governments. Assuming that demand is stable geographically and that the cost of producing public output varies from one area to another, crosssectional data on public expenditures can be used to identify the social demand. The idea underlying an aggregate demand function of this type is that the social demand for public output is expressed by the willingness of governments to appropriate funds for alternative quantities of output received. Given an estimate of the aggregate demand for nonmarketable output, an excess project demand can be obtained by subtracting from this estimate the supply that would be produced by government without the project.

In those few instances in which licenses to exploit public goods and services are sold, as is the case with respect to fish and wildlife, there is some hope of being able to estimate aggregate demand directly from cross-sectional data on license fees. Where there exists no market price for the asset produced or saved by the project, as is the case with respect to human capital, a benefit might be estimated by capitalizing expected net income streams.

The task of assigning dollar values to nonmarketable outputs may not be as hopeless as many in the field of resource analysis would have us believe. In fact the theoretical and empirical difficulties associated with identifying the social demand for public goods and services may be no greater than the problems encountered in an attempt to identify the demand parameters for marketable outputs.

When a good is entirely a public good and the parameters governing social demand are unknown, the rational approach to resource allocation is to maximize per capita output (consistent with some rule or restraint specifying an equitable distribution) for a given appropriation. This approach would be equivalent to minimizing the per unit cost of producing public output.

Given a behavioral rule which specifies that the costs of producing any quantity of public output must be minimized, it is immediately apparent that the marginal cost of producing a comparable public good by the cheapest alternative means imposes an upper limit to the excess demand for project output. To fully define the excess demand function for the nonmarketable output of a given project, it would be necessary to know, in addition to the alternative cost of producing project output, the aggregate amount government is willing to appropriate for production of the good in question and the rules to insure that the good in question is equitably distributed.

[9] An expedient way of estimating nonmarket values associated with project investment is to estimate an excess demand for the closest marketable substitute and assume this estimate will approximate the true excess demand.

[10] One of the chief problems associated with estimating the social demand for intangibles is developing suitable measures for quantifying output and/or consumption.

Viewed from a slightly different perspective, excess demand for a nonmarketable output is a schedule of average prices paid for alternative project outputs by an agency endowed with the responsibility of purchasing and distributing at minimum cost the entire public output.

Although the idea of alternative cost pricing is used extensively by the various agencies in measuring benefits, little attention is paid to the fact that distributional considerations and the aggregate willingness of government to appropriate funds for nonmarketable output is expected to eventually create inelasticity in the excess (project) demand for such output.

Assigning Market Values to Output

Placing a value on public output has as its objective a narrowing of the alternatives that must be considered in order to insure a social maximum. By assigning a market value to the resources used to produce project output and by agreeing to accept only those projects where benefits equal or exceed costs, one excludes from further choice analysis the market alternatives which would yield benefit-cost ratios of unity. The market values assigned to project resources can be presumed to reflect the value of the alternative product forgone by society in the market as a result of the project.

Public investment in the market must always be considered a relevant choice alternative if project resources are assigned social costs which are less than their market value in producing comparable product. A given project would not be socially justified unless it were expected to yield a greater surplus of benefits over costs than could be obtained by diverting its resources into the market.

The idea of costing resources, so as to narrow the range of alternatives that must be considered in order to achieve a social maximum can be extended to social as well as to market alternatives. With respect to irrigation, for instance, the use of water as an agent of dilution in pollution control has a certain opportunity return.[11] The pollution control alternative can be excluded in a choice sense from further analysis by costing the opportunity return forgone as a result of using the water for irrigation.

If opportunity returns forgone as a result of a project are left out of the benefit-cost ratio this implies that the optimum cut-off point [12] for rationing

[11] See Edward F. Renshaw, "Value of an Acre-Foot of Water," *Journal of American Water Works Association* (March, 1958), pp. 303-309.

[12] According to the March, 1957, issue of *The Farm Real Estate Market*, the net return expected from rented agricultural land is six per cent. The Bureau of Reclamation uses a two and one-half per cent interest rate to convert benefits and costs to average annual equivalents. The present value of $0.035 per year (the difference in discount rates) for 50 years, discounted at two and one-half per cent is $0.99. By merely investing a dollar in fully developed land, the Bureau could expect a 99-cent surplus of benefits over the

resources within and between projects is in excess of unity. In view of the fact that a benefit-cost ratio in excess of unity implies to many that a project ought to be undertaken, a case can be made for including in project analysis all opportunity costs associated with the construction of a given project.[13] Benefit-cost ratios that ignore opportunities forgone can be grossly misleading. From an efficiency standpoint such ratios lead to a misallocation of resources vis-a-vis the public and private sectors, if not to real wealth losses.

Currently the most flagrant example of undervaluing the resources used to produce project output, is in the use of discount rates approaching the yield on long-term government bonds.[14] The government borrowing rate is irrelevant in converting resource flows to equivalent average annual flows, since the risk to the holders of government securities is not at all comparable to the risk associated with public investment in water resource projects.

The current justification for the use of the government borrowing rate is that it reflects a pure rate of return to capital. Since there may be a positive liquidity yield associated with the holding of government securities and additional tax advantages occurring to holders of state and municipal bonds, it can hardly be argued that government rates reflect a pure return. Pure rates of return to capital, if in fact rates exist,[15] would probably be higher.

Unless risks and uncertainties associated with the construction and development of water resource projects on public account are commensurably different from risks associated with private development, there would seem to be little point in differentiating between a return component and a risk component in the discount rate used to convert costs and benefits to comparable average annual equivalents. If risk is to be treated explicitly in terms of specific allowances for contingencies, conservative benefit estimates, and fixed terminal dates, such allowances should be collapsed into an average rate to be directly compared with risk premiums associated with the production of comparable products in the market. Otherwise the public has little assurance that adequate allowances have been made in the project analysis to provide for the real risks and uncertainties inherent in resource development.

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assumed social cost of obtaining a dollar to be invested in a far more risky venture, the production of new land. If capital is to be rationed in terms of its opportunity cost, only those reclamation projects expected to yield a benefit-cost ratio of 1.99 to 1.00 should be built.

[13] One effect of a costing practice of this type would be to eliminate from further choice consideration all mutually exclusive alternatives that would yield less than a maximum surplus of benefits over costs.

[14] See Arnold C. Harberger, "The Interest Rate in Cost-Benefit Analysis," *Federal Expenditure Policy for Economic Growth and Stability* (Washington: GPO, November 5, 1957).

[15] A more appealing "rate of return to capital" could be obtained by taking a weighted average rate of return on the capitalized value of all producer wealth stocks.

Measurement of Costs

In general, the measurement of resource costs used by a project is similar to the measurement of benefits. If resources used by a project are only a small proportion of total resources available for project use, we assume perfectly elastic factor supply curves. Prevailing factor prices will reflect the exact value of the alternatives forgone as a result of the project. If some of the resources used by the project have inelastic supply curves, a linear approximation of their social cost can be obtained by averaging the resource prices expected to prevail with and without the project. As before, the cost of nonmarketable values and opportunities forgone as a result of a project is the net social surplus (benefit) forgone.

A few words should be said with respect to social costs of water resource investments generally overlooked. First both the direct and indirect costs are associated with obtaining federal money. The direct costs consist of scarce resources used up in the process of collecting taxes and/or borrowing funds. The indirect costs consist of certain consumer and producer surpluses forgone as a result of the imperfect way in which the government obtains its funds.[16] Although costs of obtaining federal funds may be only a small percentage of total project costs, these costs should also be considered in project analysis.

A second category of costs generally not considered to be project costs consists of administrative costs borne by the various agencies responsible for resource development and by the legislative branch of government. These costs typically represent a sizable proportion of the total costs associated with resource development programs. That portion of total administrative costs marginal to each project should be included in project justification.

The fixed administrative costs of any agency can be justified only if they are less than surplus of aggregate benefits over costs for the agency's total program. If the fixed costs of administering an agency are high in relation to its total expenditures, there should exist, in addition to benefit-cost analysis for individual projects, an over-all benefit-cost analysis that would ascertain the justification of the entire agency program in terms of whether the aggregate benefits produced exceed all costs incurred by the program.

An aggregate appraisal of the net social benefits stemming from any agency's program should concern itself not only with an *ex anti* benefit-cost analysis, but with an *ex post* analysis of the effectiveness of past investments. On both efficiency and distributional grounds, it would seem that far too little attention has been paid to the value of developing a framework for making *ex post* benefit-cost analyses.

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[16] Prof. Arnold Harberger at the University of Chicago has estimated, using a formula developed by Hotelling, that the welfare loss associated with the federal excise tax ranges from one to 25 per cent of the tax revenue collected; the median percentage being five per cent of the tax take.

BIAS IN ESTIMATING PROCEDURES

In the second part of *Toward Responsible Government*, an attempt was made to analyze, in as rigorous a manner as possible, one major aspect of water resource development; namely, reclamation. On the basis of survey and other information, the benefits and costs associated with individual projects were scrutinized, and the results of an appraisal of 43 existing irrigation projects were presented. Only about a fourth of these projects now appear to have been justified on the basis of realized benefits exceeding costs. If average benefits on various existing projects in 1956 are compared with expected cost allocations associated with proposed irrigation investment in the Missouri and Colorado River basins, only one of the 30 units and divisions proposed for these two projects can reasonably be expected to have a net benefit-cost ratio in excess of unity; the majority of the proposed units have net benefit-cost ratios substantially less than 0.5. The conclusion is inescapable that contemporary federal investment in both the Missouri and Colorado River basins cannot be justified on the basis of expected increases in land and water values exceeding costs. This being the case, the question arises as to precisely how such projects are made to appear justified. The answer to this question will be made clear in the following analysis of proposed irrigation in the Goshen Park Unit of the North Platte River basin. The potential Goshen Park Unit is located near Torrington, Wyoming, in east central Goshen County, Wyoming, and northwestern Scotts Bluff County, Nebraska. It would irrigate approximately 62,560 acres of undeveloped class two land lying on the south side of the North Platte River above the Fort Laramie Canal. Goshen Park is the largest of eight units currently being appraised by the Bureau of Reclamation in the North Platte River basin. The procedures used by the Bureau to estimate benefits and costs are standard and representative of current appraisal techniques. The estimated cost per acre ($563.00) of constructing the Goshen Park Unit is not high in relation to recent cost allocations per acre for such projects as the Missouri and Colorado River projects. Similar results would follow if the analysis contained in this paper were made in relation to other reclamation projects.[17]

The first indication that the Bureau's estimate of irrigation benefits on the proposed Goshen Park Unit represents a gross benefit is the assumption (first line, Table 1, column 2) that the 291 families not now engaged in irrigated farming can achieve an alternative income of only $1,000.[18] This assumption is unrealistic, depicting gross imperfections in the factor market for labor. Assuming that alternative income streams of $2,560 exist outside

[17] The basic data on the Goshen Park Unit is taken directly from U.S. Department of the Interior, *North Platte River Basin Report*, Denver, Colorado: Preliminary and unpublished report, Bureau of Reclamation, Region 7, July, 1953.

[18] Includes the value of home-grown products consumed by the family, the value of the farm dwelling, and other consumer investments, and a cash allowance for family living expenditures.

Table 1

DIRECT FARM BENEFITS, GOSHEN PARK UNIT, MISSOURI BASIN PROJECT

ITEM	DEVELOPMENT WITH PROJECT (1)	DEVELOPMENT WITHOUT PROJECT (2)	DIFFERENCE (3)	FACTOR (4)	BENEFIT (5)
Improved family living	$ 990,720[a]	$ 560,760[b]	$ 453,960	100%	$ 453,960
Increased cash farm income	715,563	0	715,563	100%	715,563
Accumulation of equity	12,067,047	2,508,480	9,558,567	1%	95,586
Total direct farm benefits					1,265,109
Development period factor (88.5%) multiplied by direct farm benefits equals total annual net direct irrigation benefits					1,119,621
Present value of total annual net direct irrigation benefits (discounted at 2.5% for 150 years)					43,666,061
Present value per acre					698
Construction costs per acre[c]					563
Benefit-cost ratio ($698 ÷ $563) = 1.24					

[a] $2,560 family living allowance for 387 farm families.
[b] Represents dryland conditions without irrigation where 96 families achieve a living allowance of $2,560, and 291 achieve an alternative income of $1,000.
[c] Derived by dividing the 1952 reconnaissance estimate of construction costs on the Goshen Park Unit ($35,204,000) by the proposed acreage (62,560).
Source: The basic data on the Goshen Park Unit is taken directly from U.S. Department of the Interior, *North Platte River Basin Report*, Denver, Colorado: Preliminary and unpublished report, Bureau of Reclamation, Region 7, July, 1953.

the area (and they surely do), families could move and be equally as well off as they would be if the government invested capital in irrigation and they remained locally employed. National income cannot be expected to increase as a result of labor being employed on irrigated farms unless it earns a greater return than would be attained if it were employed elsewhere in the economy.

If families can, in fact, achieve an alternative income stream outside irrigated agriculture of $2,560, this benefit attributed by the Bureau to irrigation would be zero; and the Bureau's estimate of net direct benefits should be reduced by 36 per cent. A deduction in direct benefits of 36 per cent would lower the Goshen Park benefit-cost ratio from 1.24 to 0.79.

As far as the Bureau is concerned, increased farm income (Table 1, second line) refers to an item in the budget study termed payment capacity. Payment capacity (see Table 2) certainly is not a net benefit attributable entirely to the project's construction costs; part of a farmer's payment capacity must be used to cover annual operation and maintenance charges. Amortization capacity would be a much better measure of the theoretical increase in cash farm income due to project construction. In fact, it is on the basis of expected amortization capacity that the Bureau negotiates its repayment contracts with the irrigation districts. Deduction of operation and maintenance charges from increased cash farm income would reduce

Table 2

SUMMARY OF INCOME AND EXPENSES, REPRESENTATIVE 160-ACRE FARM, GOSHEN PARK UNIT OF THE MISSOURI BASIN PROJECT

	PER FARM
Receipts	$12,655.00
Farm privileges	811.00
Total	$13,536.00
Farm expenses	9,127.00
Net farm income	$ 4,409.00
Family living allowance	2,560.00
Payment capacity	$ 1,849.00
	PER ACRE
Payment capacity	11.56
Less operation and maintenance charge	4.25
Amortization capacity	$ 7.31
Amortization capacity, less 11.5% development factor	$ 6.47

the Bureau's estimate of direct benefits by another 21 per cent, leaving 43 per cent, and would further reduce the resulting benefit-cost ratio from 0.79 to 0.53.

It is difficult to imagine how the Bureau can rationalize that one per cent of expected equity accumulation (which includes the farm investment in land, feed, buildings, machinery, and livestock) represents a direct benefit from irrigation. The fact that people save part of their incomes (forgoing current consumption) and invest it either directly or indirectly in irrigation enterprises rather than something else does not, in itself, imply a net benefit from irrigation. For a net benefit to accrue, the return on capital invested in irrigation must be higher than the return on the same capital invested elsewhere in the economy. (This would include the possible return to lending the same funds to nonirrigation farmers and letting them make investments.) An analysis of the assumptions underlying the farm budget appraisal of expected returns under irrigation does not indicate a greater return on capital invested in irrigation on the proposed Goshen Park Unit than might currently be earned on funds invested in other equally risky business investments. The budget study assumes a modest five per cent return on invested farm capital.[19] This can be contrasted to an average return of six per cent expected to accrue from all rented agricultural land in the United States in 1956.[20]

In terms of the Bureau's own analysis, it seems fair to assume that the expected return on equity accumulation will not be greater than the return on the same funds invested elsewhere. One, therefore, should not attribute any return on farm equity to the construction of the irrigation project. Deletion of one per cent equity accumulation decreases the Bureau's estimate of direct benefits an additional eight per cent, leaving a final net direct benefit amounting to 35 per cent of the Bureau's original estimate of direct benefits. With this adjustment, the resulting benefit-cost ratio is reduced from 0.53 to 0.43. All three adjustments combined have reduced the benefit-cost ratio from 1.24 to 0.43. The only benefit remaining, which can reasonably be expected to be a net benefit attributable to the act of public investment in irrigation, is amortization capacity. It has already been pointed out that this is precisely the benefit estimate upon which repayment contracts are negotiated.

As was argued earlier in this paper, a benefit-cost ratio of 0.43 is still too high, owing to the fact that a 2.5 per cent discount rate is used to make benefits and costs comparable. If amortization capacity is discounted by a 4.5 per cent rate, which was the average rate on farm mortgage loans in 1950, the resulting benefit-cost ratio is further reduced to 0.25. This ratio is slightly in excess of an alternative benefit-cost ratio calculated on the basis of a functional relationship existing in 1950 between land and water value per acre on 30 Bureau of Reclamation projects and the acreage percentage devoted to various crops.[21] One is led to conclude that budget-study estimates of irrigation benefits might not be so "bad" from the standpoint of determining an optimum resource allocation if care were taken to use an appropriate discount rate and if the procedure used to determine repayment capacity also determined project justification.

By way of summary, the Bureau's procedure for estimating direct farm benefits leads to a gross benefit estimate; i.e., it includes certain items which should be offset by other expenses incurred by the farm enterprise. It follows that the Bureau's benefit estimate could not be collected from irrigation farmers in the form of water repayment contracts without coercion. By including in direct benefits from irrigation a sufficient proportion of increased gross farm receipts, nearly all direct benefit-cost ratios could be made to exceed unity and appear to be economically justified in the sense that estimated benefits equal or exceed estimated costs.

[19] An additional bias in the direction of an overestimation of the true benefit from irrigation is introduced by virtue of the fact that the budget study estimate of the value of farm investment under irrigation is extremely low. The value of the land before irrigation, for instance, is assumed to be the long-time average value of nonirrigated land which is considerably less than what the land could be purchased for in the market today.

[20] USDA, *The Farm Real Estate Market* (November, 1956), p. 16.

[21] For more detailed analysis of this functional relationship see Chapter XIII of *Toward Responsible Government*.

Federal Public Land Laws and Policies Relating to Intensive Agriculture

WORKING PAPER

Federal Public Lands: Probable Effects of New Cropland on Local and Regional Economies in Western United States

Prepared for the
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APRIL 30, 1969

REVISED OCTOBER 1969

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This study is part of the research being done by the University under contract with the Public Land Law Review Commission. The opinions, findings, conclusions and data expressed in this publication are those of the authors and not necessarily those of the Public Land Law Review Commission. This publication constitutes only one of a number of sources of information utilized by the Commission in the conduct of its public land study program.

FEDERAL PUBLIC LANDS: PROBABLE EFFECTS OF NEW CROPLAND ON LOCAL AND REGIONAL ECONOMIES IN THE WESTERN UNITED STATES

C. M. Johnson and R. L. Berry

I. INTRODUCTION

Should arable federal public lands be developed for crop production at this time? The answer depends on at least three important considerations:

1. The amount of lands that are likely to be available.
2. The need for these lands to help meet the expected demand for food and fiber in 1980 and 2000.
3. The probable effect of the development of new lands on regional, State, and local economies of the West.

A survey made of seven major federal agencies revealed that 2.0 million acres of federal lands are suited for dryland crop production, and 1.3 million acres are suited for irrigated crops in 17 Western States. (The location by States is shown in Table 1, and the results of the survey are in Volume IV of this report.) However, only lands held by the Bureau of Reclamation, the Bureau of Land Management, and the Corps of Engineers are considered available. These total 1.6 million acres--705,000 for dryland and 941,000 for irrigated crops. Arable lands held by other federal agencies are reserved as forests or for game, recreation, or national defense and are unlikely to be considered for intensive agriculture.

The need for these arable public lands to meet national food and fiber demands of 1980 and 2000 has been explored in Volume V of this report. That study indicates that, despite an expected increase in population of 75 percent by 2000, there will be no need for these 1.6 million acres for crop production in the foreseeable future. At present only 300 million acres of cropland are being harvested, and 61 million have been retired under government programs. Another 338 million are

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available for regular crop production when needed, and there are about 160 million acres of other lands that could be used for occasional crop production! In addition, crop and livestock yields are expected to continue to increase in the years ahead.

Even though these arable federal lands are not needed nationally, should they be developed to benefit the Western States and their local economies? Since the Public Land Law Review Commission is expected to make a recommendation regarding this question, this study was made to provide the Commission with indications of the possible benefits of such land development to three local economies of the West. Specifically, the contract (Appendix A, 4g) calls for the joint selection of three areas and specifies that "the economy of the county or counties selected for study will be essentially oriented to agriculture, but with an urban trade center large enough to allow the contractor to identify and analyze the multiplier effect of changes in the agricultural sector upon the other sectors of the local economy. The analysis is to be based on information available from various government and other reports and shall provide answers to the following questions:

(1) What changes have taken place in the economy of the study area between 1950 and the present in terms of such measures as population, employment, per capita, and per family income, and local property tax collections?

(2) What changes have taken place in the agriculture sector of the study area, including changes in number of farms, average size of farms, farm and per farm income, farm employment, and cropping patterns?

(3) To what extent can the economic development of the study area and changes in area and individual wealth positions be attributed to the development of agriculture on new lands? Segregate effects on population, employment and income for agriculture, agriculture-related industry, and other export base industry or activity. Identify major developments that have taken place in the nonagriculture sector that have influenced development of the regional economy.

(4) On the basis of available information, identify and quantify, to the extent possible, changes in the economy of the study area that could take place during the next decade as a result of the development of additional new agricultural lands."

The three areas selected for intensive study were Yavapai County, Arizona; Cassia County, Idaho; and Phillips County, Montana. These counties were chosen because:

(1) they have public land areas large enough so that a change in use could have an important effect on the local economy,

(2) they are typical of many counties in the West,

(3) they are relatively free from other factors which might influence economic activity in the community,

(4) they have arable lands that can be bought into production without excessive costs, and

(5) they had a relatively large increase in agriculture between 1949 and 1964.

Subsequently it was decided to show, insofar as data permitted, the probable effects of development of the new lands on the West as a region and on 11 Western States as well as on the three local economies.[1] Briefly, this report will attempt to answer these questions:

What is the relative role of agriculture in the West? (Part II)

What would be the likely contribution of arable federal lands to regional and State economies? (Part III)

What changes have occurred in the rural economies of the three selected counties? (Part IV)

What are some of the changes in urban and public areas of the three selected counties? (Part V)

What effect would the development of arable federal lands have on the selected counties? (Part VI)

II. THE ROLE OF AGRICULTURE IN THE WESTERN ECONOMY

Typically, many people think of the Western United States, except for the Pacific coast, as being vast treeless prairies, tumbled mountain ranges, and primeval forests. Such a view is correct even today, but it fails to recognize the changing demographic, economic, and geographic faces of the West. Other people think of the Western States as being dominated by agriculture, particularly cattle ranching. Such a view was, of course, essentially correct for the West of yesteryear. However, the agricultural industry of the region today can be characterized as being both broadly diversified and highly specialized, for example, the citrus fruit and garden crop area in southern California, the apple growing sections of Oregon and Washington, the potato area in southern Idaho,

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[1] The total acreage of arable federal lands in these 11 Western States is 1.5 million--the other 100,000 acres of the 1.6 million in the 17 Western States are in the six States not included in this part of the study.

wheat areas in Montana, and garden crop production on irrigated land in Arizona. There remain, of course, considerable generalized farming and specialized range cattle production in extensive areas of the West not suited to specialty crop production.

Total agricultural production has increased in both physical and monetary terms since the West was settled, and it undoubtedly is still increasing. Products of western agricultural industry help to feed the rapidly growing population of both the Western States and the nation as a whole. Nevertheless, agricultural production is not dominant even though such production, along with mining and forestry, is still basic to the economy of both the region and the nation.

Direct agricultural production of crops and livestock represents less than 10 percent of the total economic production of the 11 Western States and combined with agricultural product processing it represents one-sixth of the total economic activity (Table 2). The growth of non-agricultural industry and other economic activities has relegated total agricultural production and processing to a relatively minor role which is likely to decline in the future. Although empirical evidence is not presented here, history indicates that as a geographic area develops, it tends to become relatively less agrarian and more urban. Even though agricultural production may increase somewhat, its relative role in terms of total economic activity declines.

The role of agriculture in the economy of each of the 11 Western States varies considerably (Table 2). First, the combined agricultural production and processing enterprise represents one-third or less of total economic activity in any of the several States, including those usually thought of as predominately agrarian. Second, livestock production exceeds other agricultural production in importance in only two States, New Mexico and Utah. Third, other agricultural production equals or exceeds livestock production in importance in Arizona, Montana and Wyoming, all usually considered as specialized range cattle production States. Fourth, agricultural processing is more important than direct agricultural production in California, Oregon, Utah and Washington--indicating products requiring extensive processing, handling, and packaging before they reach the consumer. Fifth, and very surprising, the combined agricultural production and processing enterprise represents 12 percent or less of total economic activity in Nevada, New Mexico, Utah, Washington, and Wyoming--States usually considered primarily agrarian.

Some counties in the West are practically devoid of any hamlet, village, or town, and economic activity is nearly all agricultural. A few counties are entirely urban or nearly so; accordingly, the relative role of direct agricultural production in the economy approaches zero, but the role of the agricultural product processing industry may still

be significant. Most counties fall between these two groups. In many, agricultural production and product processing are the predominant economic activities; in other counties agriculture represents less than 25 percent of the total productive activity.

The effects of bringing new agricultural land into production would be significantly different among the counties depending upon the dominance of agriculture in the economy. If a given county is predominantly agrarian, the primary effect would be on agricultural industry with the secondary effect (business generating effect) primarily benefiting larger geographic economies. The larger the economic area the larger the secondary or business generating effect. Accordingly, the secondary or business generating effect of new agricultural land would tend to be greater for a given State than for any county within the State and greater for the western region as a whole than for any State within the region.

III. POSSIBLE CONTRIBUTIONS OF NEW FEDERAL LANDS TO THE WEST AND TO STATE ECONOMIES

What would be the probable effect of the development of 1.5 million acres of arable federal lands on the West as a region and on individual Western States? (Table 1) This depends on (1) the acreage of dry and irrigated land, (2) the crops likely to be grown, (3) the yields of these crops, (4) the price or value of the crops, and (5) the indirect effects of this production on the economy. Once these direct and indirect effects have been calculated, they can be compared with current production in the region and in each of the States.

In the 11 States 58 percent of the harvested cropland is irrigated land, while 63 percent of available federal lands suited for crop production are deemed irrigable. Since State by State comparisons in Table 3 reveal that the proportion of these new public lands compares favorably with the present situation, it is assumed that crops and yields on the new lands would be the same as those presently achieved. The new federal lands were, therefore, divided among the various crops on the same basis as planted acres, and the results are shown in Table 4. Hay, fruits and vegetables were all omitted in this analysis.

Crop yields used for new federal lands were 19-year averages for each of the States (Table 5). Estimated total crop production by States and crops is shown in Table 6. Total values of these crops for each State were calculated at 1968 prices and are presented in Table 7.

These total values are the direct effects of developing new federal lands. But economic development is a complex matter since direct effects have indirect effects on all other sectors of the economy. Indirect effects can be determined by a complex, mathematical method called input-output analysis. The result is an output multiplier for each sector of the economy studied. This multiplier indicates how much indirect effect should be added to the direct effect to get the total output effect on the economy.

Output multipliers for various sectors of the economies of 11 Western States are in Table 8. Note that these studies by different research workers have divided the agricultural production of each State into sectors with range livestock, crops, and agricultural processing being the most popular.

While output multipliers have not been developed for the West as a region, the simple averages at the bottom of Table 8 may give some indications as to what might be expected. For every $100 of new crops produced, $136 would be the total output effect on the economy--assuming that 1.36 is the correct output multiplier.

The effect of crop multipliers on the estimated production of the federal lands is shown in Table 9. Because Idaho, Montana, Oregon and Utah do not have a "crops" multiplier, their "other agriculture" multiplier was used (excluding range livestock). In States with little, new land, both direct output and total output effects are small. New Mexico with no arable federal lands is the extreme example and is followed by Utah and Nevada.

The total output effect for the 11 Western States is $114.3 million or $1.3 million less than if the average crops multiplier of $1.36 had been used. Even this multiplier is probably low since in a region as large as the West, there would be more opportunities for inter-industry trade than within any State.

How much would the direct effects of new federal lands increase the value of crops produced in the 11 Western States? Percentage increases are shown in Table 10. For the West as a region, the increase is only 2.0 percent. Wyoming shows a surprising 32 percent increase. However, this percentage is misleading since Wyoming has only 1.7 million acres of cropland but 0.6 million acres of arable federal lands that could be developed. Idaho is second highest with a 10 percent increase. Colorado ranks third with an increase of only 2.6 percent and is followed by Oregon with 1.7 percent. In all the other States increases are well below 1.5 percent.

When the total value of crops that might be produced on arable federal lands is compared with total output of the economy of each State, any increase is insignificant. For example, the Western States as a

region had a total economic output of 67.3 billion dollars (Table 11), and the 114.3 million dollars from arable federal lands would be less than 0.2 percent of that amount. It should be emphasized, however, that crop production on these lands might be of considerable value to the local communities.

The question remains as to whether these lands should be developed in view of the present 61 million acres of idle cropland along with no need of additional land for producing food and fiber in the foreseeable future. If strengthening the economies of the West is desirable, then alternative possibilities should be explored. This is particularly true where the development of arable federal lands for irrigation may require subsidies that exceed $1,000 an acre (see Volume V of this report).

IV. SOME CHANGES IN THE RURAL SECTORS OF THREE SELECTED COUNTIES IN ARIZONA, IDAHO AND MONTANA

As noted previously, the three counties selected for intensive study were Yavapai County, Arizona; Cassia County, Idaho; and Phillips County, Montana.

Yavapai County, in west central Arizona, is just west of Flagstaff and north-northwest of Phoenix. Prescott, near the center of the county, is the largest city.

Cassia County, Idaho, is in the southernmost tier of counties east of Twin Falls. The Snake River forms its northern boundary. Burley is its largest and only city.

Phillips County, Montana, lies between the Canadian border on the north and Fort Peck Reservoir on the south. U.S. Route 2 crosses the middle of the county; Malta is the largest town and the county seat.

The sizes of these three counties with the percentages devoted to farms and ranches in each are shown in Table 12. It should be recalled that the U.S. Bureau of the Census does not distinguish between farms and ranches, and therefore much of the land in farms may be grazing land. However, federal, State, and county lands used under permit are not included in farms.

There has been considerable increase in lands in farms in all three counties since 1949, but in Yavapai County very little of this additional land has been used for crops (Table 12). While Yavapai had a 2,000-acre increase in cropland, it had a 4,000-acre decrease (33 percent) in

harvested acres during this period. Both Cassia and Phillips had large increases in total cropland and cropland harvested. Irrigated cropland increased only 1,000 acres in Yavapai, 14,000 in Phillips, and 90,000 acres in Cassia (Table 13).

What effect have these changes in cropland acres had on the economies of these three counties? That there were some positive effects cannot be doubted, but specific effects are very difficult to identify. Many other factors besides increases in cropland affect such economies. One of these factors is the decline in the number of farm families (Table 13). There was a sharp decrease in the total number of farm workers between 1940 and 1960, and further sharp decreases are projected for 1970.

One of the reasons for decreasing farm employment is the rapid decline in the number of farms (Table 14). This decline has resulted from new technology which makes it possible and necessary for farm families to operate larger acreages. The decline in farm numbers and the increase in farm sizes are expected to continue with smaller farms being absorbed by larger, more efficient units.

Realized net incomes per farmer are shown in Table 15. In Arizona and Idaho these figures indicate substantial increases, but in Montana incomes in 1964 were somewhat less than in 1949. This difference may have been due to cattle prices, but the cause was not determined. Phillips County (Montana), however, showed some increase in net income per farm but not nearly so much as Cassia County. Despite the large increase in the average farm net income in Arizona as a whole, Yavapai County had a decrease in farm income.

The value of farm real estate increased remarkably in all three States between 1949 and 1964. In Arizona the value per acre went up 340 percent while in Idaho and Montana it increased 200 percent. Part of the rise is undoubtedly due to greater efficiency and productivity of the land, and part is due to inflation and speculation. However, the demand for land to enlarge farms seems to be a basic factor in the rapid increase in land prices all over the nation.

V. CHANGES IN THE URBAN SECTORS OF THREE SELECTED COUNTIES

Since the three counties, Yavapai in Arizona, Cassia in Idaho, and Phillips in Montana were selected by the same criteria, it is not surprising that they have certain characteristics in common.

In all three counties rural population decreased (Table 16). The decline, part of a national trend caused by the mechanization of agriculture, brought about a similar decline in rural trade areas, but urban

populations increased--from 1 percent in Phillips County to 114 percent in Yavapai County. In the latter an influx of light industry in Prescott and vicinity caused the marked rise. This influx was possible primarily because of the proximity of Prescott to other larger population and manufacturing centers. In Cassia County, increases in the population and labor force were a response to the growing number of agricultural processing plants made possible because of increased irrigated crop production.

Total population in Yavapai and Cassia Counties increased by approximately 10 percent, but Phillips County experienced a decline of almost 25 percent. The population loss in Phillips County reflects not only the decline in farmers but also the decline of small trade centers and consequent loss of population, labor force, and business to larger trade centers. In general, changes in the labor force follow the pattern set by population changes. There was a marked decrease in the number of persons employed on farms in all three counties between 1940 and 1960.

There was considerable improvement in personal income in the three counties from 1950 to 1960 (Table 17). In Yavapai County families with incomes over $5,000 increased from 15.5 percent in 1950 to 64.2 percent in 1960. In Cassia the increase was from 15.4 percent to 50.5 percent. Even in Phillips County the increase was from 17.0 percent to 40.6 percent. In all three counties the median family income rose by more than 40 percent during the same decade.

Retail trade expanded between 1948 and 1963--both the number of retail establishments and the volume of business increased (Table 18). However, the percentage increase in number of retail outlets was considerably less than for the mountain region as a whole but exceeded that of the United States. In average sales volume all three counties lagged behind their respective States, the mountain region, and the United States.

Wholesale establishments in minor trade area centers would logically tend to be smaller on the average than those in major trade centers. Such a tendency is indicated by the volume indexes which are consistently less for each of the three counties than those for larger geographic-economic areas (Table 19).

Cassia County had the best wholesale trade situation. It not only had the largest, absolute wholesale trade volume increase but also the largest relative increase and a competitive volume increase. Wholesaling in Phillips County was comparable to that in Cassia County but not to the same degree, partially because of a decline in the number of wholesalers. In Yavapai County, wholesaling not only had the smallest absolute and relative growth, but it also had a competitive decline. Trade area competition was partially responsible, but an increased number of wholesalers was the primary reason.

Service establishments were not very numerous in the three counties (Table 20), and small increases in numbers resulted in relatively large percentage increases. However, increases in numbers were fewer than those in larger economic and geographic areas.

The average sales volume also rose in each county, but again the small base resulted in a large percentage increase. Yet the increase in each case was only about half that of the related State and was only about one-third that of the region and nation. Volume indexes for the three counties sharply declined between 1948 and 1963, and the gaps between them and their related larger areas widened.

Manufacturing increased considerably in Yavapai County between 1954 and 1963 (Table 21). The number of manufacturing firms increased from 22 to 39, or 78 percent; the value added by manufacturing rose from $1,550,000 to $7,099,000, or about 350 percent; and the number of regular employees increased from 299 to 499, or 67 percent. Major areas of advance were (1) stone, clay, and glass products, from 3 to 12 firms; (2) lumber and wood products, from 2 to 8 firms; and (3) equipment manufacturing, from 2 to 5 firms.

In Cassia County four new manufacturing firms started business between 1954 and 1963, a one-third increase, but both the value added ($1,099,000 to $9,165,000) and regular employment (184 to 1,496) were slightly over eight times greater in 1963.

The changes in numbers of firms in various manufacturing categories were rather diverse in Cassia and Yavapai Counties. Increased industrial activity in both counties bolstered their economies and helps to explain, at least in part, their population increases and better personal income situation in comparison with Phillips County.

Retail and selected services sales volume per capita and also population per retail and selected service establishment are presented in Table 22 for each of the selected counties and its related State. As is to be expected, none of the counties compares favorably with its respective State. These counties were selected as representative of the many rural counties in the West that lack natural resources, transportation, favorable location and climate, water, or other essentials for economic growth.

It was hoped that a study of these counties would reveal how the development of arable federal lands might contribute to the economic viability of each. What has been revealed is something of the complexity of simple, largely rural economies that are becoming still more rural under influences beyond their control. Increases in cropland may have slowed the downward trend in economic activities, but they have not reversed it. The development of new farms out of the 1.5 million acres of arable federal lands is not likely to reverse this trend either. At best, it may slow it by some imperceptible amount.

VI. CHANGES IN THE PUBLIC SECTORS OF THREE COUNTIES

Despite the slight gain in population in Yavapai and Cassia Counties, per capita expenditures for public services increased (Table 23). In Phillips County, which had the highest costs of the three, the increase was partially due to a population decline. As is to be expected, all three counties placed heavy reliance on property taxes which were highest in Phillips County. Moreover, Phillips had the lowest per capita income as well as the highest per capita taxes. Its citizens paid 19 percent of their income for local taxes as compared with 12 percent in the other two counties.

What is the reason for these differences? Phillips County has only one-third the population of Cassia and only one-fifth the population of Yavapai. What is involved here is the "social cost of space" noted by Kraenzel.[2] The more sparsely populated the area, the higher the "social cost of space"—which will tend to be still higher if functions of State and local government in sparsely populated areas are made equivalent to those in more populous areas. The social cost of space is not necessarily confined to social services or to services of government; it is also an inhibiting factor to economic development or community growth and is a partial explanation of differences in incomes in areas of low and high population density.

VII. PROBABLE EFFECTS OF NEW FEDERAL LANDS ON THE SELECTED COUNTIES

An input-output analysis for each of the selected counties was not attempted. Output multipliers for most counties would be smaller than those for their States. Only in exceptional situations will some county output multipliers exceed those of the State. However, to illustrate the effect of developing new agricultural land on the county level, the State output multiplier will be used even though this will overstate the impact.

In Phillips County, Montana, the Soil Conservation Service estimated that 23,500 acres of federal lands were suitable for dryland crop production. What would this land produce? A study of several farm plans for northeastern Montana indicated that a wheat fallow rotation with some

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[2] Kraenzel, Carl F. The Great Plains in Transition (Norman: University of Oklahoma Press, 1955), pp. 201 ff.

alfalfa and about one-fourth of the land in the federal conservation reserve program would gross $12 to $14 an acre including government payments.[3] Wheat yields and price were assumed to be 13 bushels per planted acre at $1.75 a bushel.

If the new federal lands could gross $15 an acre, the 23,500 available acres would give a direct output of $352,500, or 3.9 percent of the $9.1 million paid to farmers of Phillips County for their 1964 production.

Arizona has only 6,000 acres of federal lands suited for irrigated crop production for which water is physically and legally available. (It has no federal lands suited to dryland crop production.) Whether or not these lands can be economically irrigated in unknown. Also unknown is how many of these 6,000 acres, if any, are in Yavapai County. Hence, to attempt an estimate of the direct and indirect effects of crop production would be to speculate upon a speculation. Obviously, however, if all 6,000 acres happened to be located in Yavapai County, there would be considerable impact upon the local community.

Idaho is reported to have 389,000 acres of arable federal lands--83,000 acres usable for dryland and 306,000 acres for irrigated crop production. How much of this is in Cassia County? No estimates are available, but with so much irrigable federal land in the State, it seems quite reasonable to believe that Cassia might have as much as 30,000 acres suitable for irrigation. If a three-year potato, oat, alfalfa rotation were used, the direct output can be calculated as follows:

Crop	Acres	Yield/acre	Price	Total value
Potatoes	10,000	200 bushels	$ 1.75	$3,500,000
Oats	10,000	50 bushels	.60	300,000
Alfalfa	10,000	6 tons	17.00	1,020,000
Total direct effect				$4,820,000

The total direct effect would be about $5 million as compared with $33 million in farm product sales for Cassia County (U.S. Census of Agriculture, 1964). If a multiplier of 1.30 were used, the total direct and indirect output effects would be $6.5 million for the 30,000 acres. Obviously, either of these amounts would have a significant effect on the economy of Cassia County.

[3] LeRoy C. Rude, Land Use Alternatives for Dryland Grain--Livestock Operators in Northeastern Montana, Montana Agricultural Experiment Station Bulletin 572 (1962).

VIII. SUMMARY AND CONCLUSIONS

What probable effect would the development of 1.5 million acres of arable federal lands have on the economy of the West? Of each of the 11 Western States? Of three selected counties in central Arizona, southern Idaho and northeastern Montana? These are the questions this study sought to answer.

The 11 Western States have 37 million acres of harvested cropland. Obviously, an increase of 1.5 million acres, or only 4 percent would not have a large impact on the region. Among the 11 States the effect would be greatest in Wyoming with 590,000 acres and Idaho with 390,000 acres. In evaluating the impact one should keep in mind that less than 10 percent of the income of the West comes from livestock and crops. Sources of income are as follows:

Source	Percent
Livestock	3
Other agriculture	6
Agricultural processing	7
Mining and manufacturing	29
Services and utilities	28
Trade and transportation	21
Other industry	6
Total	100

The share of income received by the various States from livestock and other agriculture is as follows:

State	Livestock	Other agriculture	Total
	Percent		
Idaho	5	13	18
Montana	7	11	18
Arizona	4	9	13
Colorado	4	9	13
Oregon	4	4	8
Wyoming	4	4	8
New Mexico	4	3	7
California	2	4	6
Nevada	1	3	4
Washington	1	3	4
Utah	2	1	3

This study indicates that the 1.5 million acres of arable federal lands might directly produce 85 million dollars of products at current yields and prices. However, this amount would increase the value of all crops harvested in the West by only 2.0 percent (Table 10).

A number of studies of the economies of several Western States suggests that the direct effect of 85 million dollars should be multiplied by 1.36 to account for the increased economic activity such production would stimulate. If so, the total output effect would be 115 million dollars. While this is a large amount, it is only 0.2 percent increase over the present value of all production (agricultural and other) in the 11 Western States (Table 11).

Wyoming and Idaho, with little cropland and considerable arable federal lands, would have the greatest increases in value of all crops harvested. The millions of dollars of crops now produced in the 11 Western States and the percentage increases that might result if federal lands were developed are as follows:

State	Harvested crops	New crops	Percentage increase
	- - - - - million dollars - - -		
Wyoming	75	24	32.0
Idaho	360	37	10.0
Colorado	262	7	2.6
Oregon	247	4	1.7
Washington	474	6	1.3
Montana	306	3	1.0
Arizona	272	1	0.2
California	2,077	2	0.2
New Mexico	116	(a)	0.1
Utah	81	(a)	0.1
Nevada	28	0	0.0

a Less than $500,000.

The direct effects of the new crops are indicated above in millions of dollars. Studies have shown that for every $100 of new crops produced, the indirect effects on other sectors of the economy make the total output effect range from $123 to $192. Stated more technically--the direct effect needs to be multiplied by an output multiplier of 1.23 to 1.92 (Table 9). The average multiplier for these 11 Western States appears to be about 1.40. Thus for every $100 of crops produced, another $40 of indirect benefits makes a total output effect of $140. But even after these indirect effects are taken into account, the $115 million total output effect is only 0.2 percent of the value of all production (agricultural and other).

An attempt was made to determine the probable effects of the development of arable federal lands on three selected counties: Yavapai in west central Arizona, Cassia on the southern border of Idaho, and Phillips in northeastern Montana. The statistics indicated changes in acres of harvested cropland, but it was impossible to ascertain how much these changes affected trends in population. Studies to determine the output multipliers of these counties were also lacking.

In Phillips County, Montana, a $15 gross return per acre seems possible on the 23,500 acres of new federal lands in that county. With this return the direct output would be $352,000, or 3.9 percent of the $9,100,000 that Phillips County farmers received for their cash sales. If the output multiplier that should be used to account for indirect effects is lower than for that for the State, say 1.30, then the total direct effect would be $458,000.

In Arizona there are only 6,000 acres of arable federal lands and all these require irrigation. The possibility that much of this land is in Yavapai County does not seem large. Hence no analysis was attempted.

Since Idaho has 389,000 acres of arable federal lands, it seems probable that as much as 30,000 acres might be in Cassia County. An irrigated potato--small grain--alfalfa rotation would give a direct output of $5 million as compared with $33 million cash sales by Cassia County farmers in 1964. If the output multiplier were 1.30, then the total output effect would be $6.5 million.

Would these direct and indirect effects justify bringing the arable federal lands into production at this time? The answer depends upon alternative possibilities and their comparative costs and benefits. One factor not considered in this paper is the cost of bringing these federal lands into production. As previously noted, some federal irrigation projects are now costing more than $1,000 an acre to develop.

IX. TABLES

(pp. 16-38)

Table 1.--Effect of available federal lands suited for crop production on total harvested cropland of 17 Western States, 1968

States	Federal public land suited for crop production[a]					Non-federal harvested cropland[c]	Increase in total cropland
	Dryland	Irrigated	Available for crops[b]				
			Dryland	Irrigated	Total		
	1,000 acres						Percent
Arizona	0	11	0	6	6	1,025	0.6
California	172	137	4	20	24	7,846	0.3
Colorado	103	88	103	86	189	4,726	4.0
Idaho	85	314	83	306	389	3,935	10.0
Montana	279	6	105	5	110	7,813	1.4
Nevada	4	7	0	3	3	507	0.5
New Mexico	(d)	11	0	0	0	906	---
Oregon	67	72	60	23	82	3,050	2.7
Utah	1	14	0	1	1	1,039	0.1
Washington	15	158	3	104	107	4,423	2.4
Wyoming	469	387	203	387	590	1,702	34.6
Sub-total	1,195	1,204	561	940	1,502	36,972	4.1
Kansas	99	43	26	0	26	18,160	0.1
Nebraska	10	5	1	1	2	15,229	0.01
North Dakota	262	4	22	0	22	17,695	0.1
Oklahoma	44	3	3	0	3	8,344	0.3
South Dakota	237	46	31	0	31	14,445	0.2
Texas	149	6	61	0	61	19,403	0.3
Total	1,996	1,313	705	941	1,646	130,248	1.3

[a]Table 2 in Volume IV of this report. [b]Only lands held by three agencies--Bureau of Reclamation, Bureau of Land Management and Corps of Engineers--are considered available for crop production. [c]U.S. Bureau of the Census, Census of Agriculture, 1964, Vol. 2, Chap. 3, pp. 248-49. [d]Less than 500 acres. Note: Figures are rounded and do not add to totals shown.

Table 2.--Percentage share of selected industry groups in total net economic activity in 11 Western States

State	Livestock	Other agriculture	Agricultural processing	Mining & mfg.	Services & utilities	Trade & transport	Other industry	Total
Arizona	4	9	5	25	39	18	---	100
California	2	4	10	36	12	16	20	100
Colorado	4	9	5	25	39	18	---	100
Idaho	5	13	14	27	14	18	9	100
Montana	7	11	14	27	14	18	9	100
Nevada	1	3	2	10	67	16	1	100
New Mexico	4	3	4	34	32	23	---	100
Oregon	4	4	10	43	27	8	4	100
Utah	2	1	5	25	15	47	5	100
Washington	1	3	8	37	18	20	13	100
Wyoming	4	4	4	35	27	26	---	100
Average	3	6	7	29	28	21	6	100

Source: Unpublished input-output study furnished by the Public Land Law Review Commission.

Table 3.--Irrigated land as a percentage of total harvested cropland and irrigable land as a percentage of arable federal land in 11 Western States

States	(1) Total harvested cropland[a]	(2) Total arable federal lands[b]	(3) Irrigated land as a percentage of col. (1)[c]	(4) Irrigable land as a percentage of col. (2)
	- - - - 1,000 Acres - - -		- - - - Percent - - - - -	
Arizona	1,025	6	100	100
California	7,846	20	97	93
Colorado	4,726	86	57	46
Idaho	3,935	306	71	79
Montana	7,813	5	24	4
Nevada	507	2	100	100
New Mexico	906	0	90	0
Oregon	3,050	23	53	25
Utah	1,039	1	100	100
Washington	4,423	104	26	97
Wyoming	1,702	388	92	66
Totals	36,972	1,501	58	63

[a]U.S. Census of Agriculture, 1964, Vol. 2, Chap. 3, pp. 248-49.

[b]Table 1 of this report.

[c]U.S. Census of Agriculture, 1964, Vol. 2, Chap. 9, p. 916 (acres).

Table 4.--Probable use of available federal land in crop production in 11 Western States

State	Corn	Oats	Barley	Sorghum	Wheat	Rye	Rice	Cotton	Potatoes	Beans	Peas	Beets	Total
	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	acres	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
Arizona	240	---	1,380	1,920	420	---	---	1,860	60	---	---	120	6,000
California	1,708	1,952	8,540	2,440	1,952	---	1,952	3,172	488	976	---	1,220	24,400
Colorado	17,037	3,786	9,465	22,716	119,259	1,893	---	---	1,893	7,572	---	5,679	189,300
Idaho	11,679	7,786	77,860	---	194,650	3,893	---	---	42,823	11,679	15,572	23,358	389,300
Montana	1,101	4,404	22,020	---	81,474	---	---	---	---	---	---	1,101	110,100
Nevada	275	450	875	---	875	---	---	---	25	---	---	---	2,500
New Mexico	---	---	---	---	---	---	---	---	---	---	---	---	---
Oregon	1,642	7,389	13,957	---	50,902	4,105	---	---	2,463	---	821	821	82,100
Utah	99	55	264	---	594	---	---	---	11	22	---	55	1,100
Washington	1,606	1,821	6,854	---	88,143	1,500	---	---	1,928	214	3,534	1,500	107,100
Wyoming	41,279	94,352	88,455	---	271,262	23,588	---	---	---	29,485	---	41,279	589,700
Totals	76,566	122,095	229,670	27,076	809,531	34,979	1,952	5,032	49,691	49,948	19,927	75,133	1,501,600

Source: For total acres of available federal lands see Table 1. Note: Crops were distributed on the basis of planted non-federal cropland as reported in Crop Production, 1968 Annual Summary by States, U.S. Department of Agriculture, Statistical Reporting Service, 19 December 1968, p. 45 ff. For distribution see appendix tables in Volume V of this report.

Table 5.--Crop yields per acre in 11 Western States, 1949 to 1967

State	Corn	Oats	Barley	Sorghum	Wheat	Rye	Rice	Cotton	Potatoes	Beans	Peas	Beets
	bushels						lbs.	lbs.	cwt.	lbs.	lbs.	tons
Arizona	25	49	60	58	35	--	--	930	232	446	--	20
California	67	37	42	59	24	12	4,170	910	270	1,389	1,236	20
Colorado	49	35	30	22	18	11	--	--	211	860	898	16
Idaho	68	47	37	--	34	19	--	--	193	1,746	1,355	18
Montana	33	35	28	--	20	16	--	--	150	1,608	--	14
Nevada	45	43	41	--	36	--	--	665	198	--	--	--
New Mexico	29	31	38	33	16	11	--	643	141	538	--	--
Oregon	61	37	37	--	31	17	--	--	232	--	1,093	24
Utah	58	49	46	--	23	10	--	--	155	436	--	16
Washington	76	48	38	--	33	16	--	--	274	1,787	1,315	23
Wyoming	36	34	33	--	20	14	--	--	143	1,444	--	15

Source: Crop Production, 1968 Annual Summary by States, U.S. Department of Agriculture, Statistical Reporting Service, 19 December 1968 and earlier reports.

Table 6.--Estimated production on available federal lands by crops in 11 Western States

State	Corn	Oats	Barley	Sorghum	Wheat	Rye	Rice	Cotton	Potatoes	Beans	Peas	Beets
	1,000 bushels						tons					
Arizona	6	--	83	112	15	--	--	865	696	--	--	2
California	114	73	357	143	47	--	4,070	1,444	6,588	678	--	24
Colorado	833	131	286	496	2,123	21	--	--	19,971	3,258	--	92
Idaho	790	369	2,850	--	6,560	72	--	--	413,242	10,195	10,552	425
Montana	36	155	628	--	1,638	--	--	--	--	--	--	16
Nevada	12	20	36	--	31	--	--	--	248	--	--	--
New Mexico	--	--	--	--	--	--	--	--	--	--	--	--
Oregon	100	276	511	--	1,573	70	--	--	28,571	--	449	20
Utah	6	3	12	--	14	--	--	--	85	5	--	1
Washington	122	87	262	--	2,918	25	--	--	26,414	191	2,323	35
Wyoming	1,478	3,199	2,954	--	5,317	323	--	--	--	21,287	--	598
Totals	3,497	4,311	7,979	757	20,233	411	4,070	2,310	495,814	35,613	13,324	1,213

Source: Derived from Tables 4 and 5. Note: Figures are rounded and do not add to totals shown.

Table 7.--Estimated value of crop production on available federal lands by crops in 11 Western States

State	Corn	Oats	Barley	Sorghum	Wheat	Rye	Rice	Cotton	Potatoes	Beans	Peas	S. Beets	Totals
							1,000 dollars						
Arizona	6	--	75	108	19	--	--	373	28	--	--	37	645
California	120	44	321	137	59	--	400	622	269	55	--	376	2,403
Colorado	875	80	257	476	2,675	21	--	--	815	263	--	1,410	6,872
Idaho	829	225	2,565	--	8,265	71	--	--	16,860	822	1,030	6,517	37,185
Montana	38	94	565	--	2,063	--	--	--	--	--	--	241	3,001
Nevada	13	12	33	--	39	--	--	--	10	--	--	--	107
New Mexico	--	--	--	--	--	--	--	--	--	--	--	--	--
Oregon	105	168	460	--	1,982	69	--	--	1,166	--	44	299	4,292
Utah	6	2	11	--	17	--	--	--	4	--	--	14	53
Washington	128	53	236	--	3,676	24	--	--	1,078	15	227	530	5,967
Wyoming	1,552	1,951	2,659	--	6,699	320	--	--	--	1,717	--	9,175	24,073
Totals	3,671	2,630	7,181	721	25,494	506	400	995	20,229	2,873	1,300	18,598	84,599

Source: Table 6 and prices received by farmers, December 1968. Note: Figures are rounded and do not add to totals shown.

Table 8.--Selected output multipliers for agricultural production and processing in 11 Western States

State	Range livestock	Other livestock	Crops	Cotton	Vegetables	Other agr.	Agr. proc.
Arizona	1.31	1.39	1.32	--	--	--	1.93
California	1.47	--	1.45[a]	1.24	1.20	1.38	--
Colorado	1.18	1.42	1.32	--	--	--	1.89
Idaho	1.50	--	--	--	--	1.35	1.67
Montana	1.40	--	--	--	--	1.35	1.34
Nevada	1.44	1.75	1.72	--	--	--	2.39
New Mexico	1.30	--	1.30	1.42	1.17	--	1.29
Oregon	1.90	--	--	--	--	1.92	--
Utah	1.79	--	--	--	--	1.52	--
Washington	1.37	--	1.23	--	1.22	--	--
Wyoming	--	--	1.28	1.45	1.15	--	1.25
Averages	1.47	1.52	1.36	1.37	1.18	1.50	1.68

Source: Output multipliers supplied by the Public Land Law Review Commission.

[a]Food and feed grain multiplier.

Table 9.--Total output effect of increased crop production from arable federal lands in 11 Western States

State	Estimated direct output effect[a]	Output multiplier[b]	Total output effect
	1,000 dollars	Ratio	1,000 dollars
Arizona	646	1.32	852
California	2,403	1.45	3,484
Colorado	6,872	1.32	9,071
Idaho	37,185	1.35	50,200
Montana	3,001	1.35	4,052
Nevada	107	1.72	184
New Mexico	---	1.30	---
Oregon	4,292	1.92	3,241
Utah	53	1.52	81
Washington	5,967	1.23	7,339
Wyoming	24,073	1.28	30,813
Totals	84,599	---	114,317

[a]See Table 7, last column. [b]See Table 7. The output multiplier for "other agriculture" was used for Idaho, Montana, Oregon and Utah because a "crops" multiplier was lacking. The California output multiplier is for food and feed grains.

Table 10.--Probable effect of new federal lands on total value of farm crops harvested in 11 Western States, 1967

States	Value of all crops harvested[a]	Value of crops from new federal land[b]	Increase in value due to federal lands
	- - - - -1,000 dollars- - - - -		Percent
Arizona	272,300	646	0.2
California	2,076,600	2,403	0.2
Colorado	261,600	6,872	2.6
Idaho	359,900	37,185	10.0
Montana	305,700	3,001	1.0
New Mexico	116,400	107	0.1
Nevada	28,100	- - -	- - -
Oregon	247,400	4,292	1.7
Utah	81,000	53	0.1
Washington	473,800	5,967	1.3
Wyoming	74,100	24,073	32.0
Total	4,297,900	84,599	2.0

[a]Agricultural Statistics, 1968.

[b]Data from Table 9. Note that these figures do not include multiplier effect.

Table 11.--Probable impact of crop production from arable federal lands on total value of all production in 11 Western States

State	Total value of all production (agriculture and other)[a]	Total impact of crops produced on arable federal lands[b]	
	- - - 1,000 dollars - - -		Percent
Arizona	3,600,000	852	0.02
California	11,600,000	3,484	0.03
Colorado	3,600,000	9,072	0.30
Idaho	2,600,000	50,200	1.90
Montana	2,600,000	4,052	0.20
New Mexico	4,200,000	184	0.00
Nevada	3,200,000	0	0.00
Oregon	13,400,000	8,241	0.06
Utah	6,900,000	81	0.00
Washington	12,500,000	7,339	0.06
Wyoming	3,100,000	30,813	0.10
Totals	67,300,000	114,317	0.17

[a]Input-output data furnished by Public Land Law Review Commission.

[b]Data from Table 9. Note that these figures include the multiplier effect.

Table 12.--Changes in land use in three selected counties in Arizona, Idaho, and Montana, 1949 to 1964

	Yavapai County Arizona	Cassia County Idaho	Phillips County Montana
County land area, acres	5,178,000	1,628,000	3,346,000
Percentage in farms	68	41	68
Land in farms, 1964, acres	3,506,000	664,000	2,274,000
Increase since 1949, acres	905,000	199,000	492,000
Percentage increase	35	43	28
Total cropland, 1964, acres	28,000	316,000	372,000
Increase since 1949, acres	2,000	135,000	58,000
Percentage increase	8	75	44
Harvested cropland, 1964, acres	8,000	204,000	200,000
Change since 1949, acres	-4,000	+79,000	+66,000
Percentage change	-33	+63	+49

Source: U.S. Census of Agriculture, 1950, 1964.

Table 13.--Irrigated land and farms, farm employment, and farm labor in three selected counties, 1949, 1964

	Yavapai County Arizona	Cassia County Idaho	Phillips County Montana
Irrigated land, 1964, acres	14,813	189,664	45,776
Change from 1949, acres	+946	+89,273	+14,158
Percentage change	+7	+89	+45
Number of farms irrigated	252	898	260
Change from 1949	-51	-252	-27
Percentage change	-17	-22	-9
Average size of irrigated farm, acres	3,887	662	3,373
Change from 1949, acres	+1,625	+333	+1,265
Percentage change	+72	+101	+60
Percentage of farms irrigated			
1949	55	92	36
1964	55	92	42
Total farm workers, 1960, number	695	1,515	942
Change from 1940	-358	-359	-453
Percentage change	-34	-19	32
Projected number for 1970	533	1,095	709
Number of workers per farm			
1950	1.7	1.6	1.4
1960	1.5	1.3	1.4
Hired farm labor working 150 days or more per year			
Number, 1964	343	591	259
Change from 1949	+41	+170	-1
Percentage change	+14	+40	-0.4
Number of workers per commercial farm			
1949	0.8	0.4	0.4
1964	1.2	0.7	0.5

Source: U.S. Census of Agriculture, 1950, 1964.

Table 14.--Farm numbers and size, 1949 and 1964, in three selected counties

	Yavapai County Arizona	Cassia County Idaho	Phillips County Montana
Number of farms, 1964	460	978	621
Decrease from 1949	-87	-270	-182
Percentage decrease	-16	-22	-23
Average size of farms, 1964, acres	7,622	679	3,662
Increase from 1949, acres	+2,867	+307	+1,442
Percentage increase	+60	+82	+65
Trend projection to 1975			
Number of farms	386	836	488
Average size of farms, acres	9,910	881	4,560
Commercial farms			
Number, 1964	283	852	554
Decrease from 1949	-91	-287	-155
Percentage decrease	-24	25	-22
Number of farms by size brackets			
Under 260 acres, 1964	289	595	84
Change from 1949	-44	-387	-41
Percentage change	-13	-39	-33
260 to 1,000 acres, 1964	46	241	267
Change from 1949	-37	+81	-5
Percentage change	-45	+51	-2
Over 1,000 acres, 1964	125	142	270
Change from 1949	-6	+36	-136
Percentage change	-5	+34	-34

Source: U.S. Census of Agriculture, 1950, 1964.

Table 15.--Farm income and farm value, 1949, 1964, in three selected counties

	Yavapai County Arizona	Cassia County Idaho	Phillips County Montana
Farm income (realized net per farm)			
Farm income estimates, 1949 (State)			
All farms	$11,615	$ 3,396	$ 5,282
Commercial farms	15,794	4,007	5,932
County estimates			
All farms	5,983	4,509	4,156
Commercial farms	8,077	4,853	4,486
Farm income estimates, 1964 (State)			
All farms	18,589	4,551	4,486
Commercial farms	25,415	5,927	5,267
County estimates			
All farms	3,378	9,747	4,570
Commercial farms	5,400	10,825	5,081
Farm real estate values			
Value of land and buildings per farm, 1949	36,551	21,521	24,252
Value of land and buildings per farm, 1964	203,804	84,512	83,126
Value per acre, 1949	7.85	61.16	11.05
Value per acre, 1964	26.71	127.25	22.59
Increase ratio per farm	5.6	3.9	3.4
Increase ratio per acre	3.4	2.1	2.0

Sources: U.S. Census of Agriculture, 1950, 1964, Economic Research Service, U.S. Department of Agriculture.

Table 16.--Population and labor force, 1960, and changes from 1940 in selected counties

	Yavapai County Arizona	Cassia County Idaho	Phillips County Montana
Population			
Total, 1960	28,912	16,121	6,027
Change from 1940	+2,401	+1,691	-1,865
Percentage change	+9	+11	-24
Urban, 1960	12,861	7,508	2,239
Change from 1940	+6,843	+2,179	+24
Percentage change	+114	+41	+1
Rural, 1960	14,300	3,383	1,536
Change from 1940	-2,872	+1,354	-452
Percentage change	-16	+67	-23
Farm, 1960	1,751	5,230	2,252
Change from 1940	-1,570	-1,842	-1,437
Percentage change	-47	-26	-39
Labor Force			
Number in labor force, 1960	10,461	6,196	2,380
Change from 1940	+644	+1,324	-814
Percentage change	+7	+27	-26
Proportion of labor force employed in agriculture			
1940 Percentage	11	38	47
1960 Percentage	7	24	40
Number employed on farms, 1960	681	1,430	903
Change from 1940	-318	-300	-409
Percentage change	-32	-17	-31

Source: U.S. Census of Population, 1960.

Table 17.--Personal income, 1950, 1960, in selected counties

Personal income	Yavapai County Arizona		Cassia County Idaho		Phillips County Montana	
Families by income classes	1950	1960	1950	1960	1950	1960
	Numbers					
Under $3000	2,950	1,051	1,880	775	770	443
$3000-4999	2,245	1,648	935	1,134	425	418
$5000-9999	825	3,949	415	1,590	200	479
Over $10,000	125	894	95	353	45	109
Families by income classes	Percent					
Under $3000	48	14	56	20	54	31
$3000-4999	36	22	28	29	30	29
$5000-9999	14	52	12	41	14	33
Over $10,000	2	12	3	9	3	8
Median family income, 1950	$3,081		$2,698		$2,844	
Median family income, 1960	5,191		5,032		4,353	
Median farm family income, 1960	3,984		5,018		3,952	
Mean personal income per recipient, 1960						
Income from all sources	3,367		3,005		3,827	
Income from wages or salary	3,268		2,304		2,148	
Income from self employment	3,918		3,779		3,848	
Per capita personal income, 1960	1,780		1,424		1,375	

Source: U.S. Census of Population, 1950, 1960.

Table 18.--Retail trade, 1963, with changes from 1948 in selected counties

	Yavapai County Arizona	Cassia County Idaho	Phillips County Montana
Number of establishments, 1963	455	237	103
Change from 1948	+31	+41	+5
Percentage change			
Selected county	+7	+21	+5
Related State	+60	-.2	-4
Mountain region	+16	+16	+16
United States	+3	+4	+4
Average sales volume per establishment, 1963	$86,571	$131,291	$82,728
Change from 1948	+30,203	+49,169	+22,412
Percentage change			
Selected county	+54	+60	+37
Related State	+92	+63	+67
Mountain region	+88	+88	+88
United States	+94	+94	+94
Volume indexes	1948 1963	1948 1963	1948 1963
Mountain region	100 100	100 100	100 100
Selected county	72 60	105 90	77 56
Related State	105 107	102 88	95 85
United States	95 98	95 98	95 98

Source: U.S. Census of Retail Trade, 1948, 1963.

Table 19.--Wholesale trade, 1963, with changes from 1948 in selected counties

	Yavapai County Arizona		Cassia County Idaho		Phillips County Montana	
Number of establishments, 1963	46		43		17	
Change from 1948	+10		--		-6	
Percentage change						
Selected county	+28		--		-26	
Related State	+154		+28		+14	
Mountain region	+54		+58		+54	
United States	+27		+27		+27	
Average sales volume per establishment, 1963	$303,935		$477,186		$258,588	
Change from 1948	+85,157		+214,372		+100,805	
Percentage change						
Selected county	+39		+82		+64	
Related State	+67		+46		+26	
Mountain region	+51		+51		+51	
United States	+50		+50		+50	
Volume indexes	1948	1963	1948	1963	1948	1963
Mountain region	100	100	100	100	100	100
Selected county	44	41	53	64	32	34
Related State	98	109	73	71	85	71
United States	156	155	156	155	156	155

Source: U.S. Census of Wholesale Trade, 1948, 1963.

Table 20.--Selected services, 1963, with changes from 1948 in selected counties

	Yavapai County Arizona		Cassia County Idaho		Phillips County Montana	
Number of establishments, 1963	261		121		41	
Change from 1948	+107		+40		+16	
Percentage change						
Selected county	+70		+49		+64	
Related State	+156		+70		+48	
Mountain region	+91		+91		+91	
United States	+60		+60		+60	
Average sales volume per establishment, 1963	$20,789		$18,074		$15,902	
Change from 1948	+6,114		+5,852		+3,102	
Percentage change						
Selected county	+42		+50		+24	
Related State	+96		+69		+47	
Mountain region	+112		+112		+112	
United States	+110		+110		+110	
Volume indexes	1948	1963	1948	1963	1948	1963
Mountain region	100	100	100	100	100	100
Selected county	78	52	65	45	68	40
Related State	100	93	87	69	83	58
United States	106	105	106	105	106	105
Total sales volume, 1963						
Retail trade		$39.4		$31.1		$ 8.5
Wholesale trade		14.0		20.5		4.4
Selected services		5.4		2.2		.7
Total		$58.8		$53.8		$13.6

Source: U.S. Census of Selected Services, 1948, 1963.

Table 21.--Manufacturing and mining, 1963, with changes from 1954 in selected counties

	Yavapai County Arizona		Cassia County Idaho		Phillips County Montana	
Manufacturing	1954	1963	1954	1963	1954	1963
Number of firms	22	39	12	16	3	3
Value added (thousands)	1,550	7,099	1,099	9,165	86	162
Number of regular employees	299	499	184	1,496	13	17
Number of firms by category						
Food & kindred products (20)	6	6	5	7	--	--
Apparel & related products (23)	2	1	1	1	--	--
Lumber & wood products (24)	2	8	--	--	--	--
Furniture & fixtures (25)	1	--	--	--	--	--
Paper & allied products (26)	--	--	--	1	--	--
Printing & publishing (27)	4	4	4	3	--	--
Stone, clay, glass products (32)	3	12	1	2	--	--
Primary metal industry (33)	--	1	--	--	--	--
Machinery, except electrical (35)	2	2	--	1	--	--
Light industry (36) (37) (38)	--	3	--	--	--	--
Unchanged categories (misc.)	2	2	1	1	--	--
Mining						
Number of firms	73	30	2	1	2	5
Value added (thousands)	9,600	12,540	NA	NA	NA	NA
Number of regular employees	700	833	NA	NA	NA	NA

Source: U.S. Census of Manufacturing and Mining, 1954, 1963.

NA--Not available (census data is not published so as to avoid disclosure for individual firms).

Table 22.--Retail and selected services volume per capita with population per retail and selected service establishment in selected counties, 1948 and 1963

	Yavapai County Arizona		Cassia County Idaho		Phillips County Montana	
Retail volume per capita	State	County	State	County	State	County
1948	877	956	988	1,100	1,020	933
1963	1,549	1,362	1,420	1,930	1,431	1,414
Selected services volume per capita						
1948	89	90	73	68	78	51
1963	257	188	185	136	149	108
Population per retail establishment						
1948	93	59	80	75	73	65
1963	101	64	91	68	87	59
Population per service establishment						
1948	213	162	224	181	200	253
1963	144	111	150	133	155	147

Source: Derived from data in previous tables.

Table 23.--Costs of local governments in three selected counties, 1957 and 1962

	Yavapai County Arizona		Cassia County Idaho		Phillips County Montana	
	1957	1962	1957	1962	1957	1962
Estimated population	27,735	30,740	15,670	16,745	6,120	5,850
Per capita direct general expenditures	$165	$206	$139	$190	$193	$229
Per capita tax revenues, total	153	213	145	166	212	259
Property taxes	68	111	53	87	126	168
Other taxes	9	11	2	2	11	7
Miscellaneous	24	19	53	34	47	36
Intergovernmental (net)	51	72	36	43	28	48
Personal income per capita, 1960	$1,780		$1,424		$1,375	
Property tax as percentage of total revenue	45	52	37	53	60	65
Property tax as percentage of personal income		6		6		12
Tax revenue as percentage of personal income		12		12		19

Source: United States Census of Governments, Governmental Finances, 1957, 1962. Per capita data were computed on the basis of aggregates.

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Federal Public Land Laws and Policies Relating to Intensive Agriculture

WORKING PAPERS

Federal Public Lands: Goals, Issues and Alternatives

Prepared for the

Public Land Law Review Commission

Washington, D. C.

By

The Economics Department

Agricultural Experiment Station

South Dakota State University

Brookings, South Dakota 57006

APRIL 30, 1969

REVISED OCTOBER 1969

PREFACE

What are the problems and goals of the people of the United States in relation to their public lands, especially those lands suited for intensive agriculture? What are some alternatives to the policies and laws presently governing the disposal or use of such lands for agricultural purposes? These and related questions are discussed in the papers in this volume to help the Public Land Law Review Commission carry out its responsibility for recommending ways that the public lands can provide maximum benefit to the general public.

The general public is obviously composed of many publics, and each has its own problems, interests, and goals which sometimes conflict. In the first paper, "Farm Tenure Problems and Goals of Farmers and Farm Landlords," the various publics are separated into two groups: (1) prospective farmers who wish to become tenants or owners of public lands suited for crop production, and (2) all the publics, including the prospective farmers, who are represented by the government acting as landlord or real estate developer.

Some insights into the problems and interests of prospective farmers are provided by an exploration of the tenure difficulties and goals of actual farmers as revealed by the literature. The evidence suggests that the most important farm tenure problems are related to the lack of the four F's: (1) fixity or security of tenure or occupancy, (2) freedom of improvement or long-run management, (3) freedom of operation or short-run management, and (4) fair rents or fair land prices and payment plans.

Attention is also given to the views of farm landlords since their views may indicate in some small way those of the general public as represented by the various federal land management agencies.

Security of tenure, freedom to improve and to operate, and fair rents and payments are also important factors in the experiences of other nations which have public lands suitable for agriculture. Various alternatives used by several countries for the management or disposal of public lands are identified and analyzed in the second paper, "Public Land Disposal by Leasehold and Freehold in Canada, Australia, New Zealand, and the Netherlands."

A supplementary article on Australian land policy by K. O. Campbell of the University of Sydney is reproduced in the Appendix.

Russell L. Berry

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FARM TENURE PROBLEMS AND GOALS OF FARMERS AND FARM LANDLORDS

Russell L. Berry

I. The Elusive Nature of Farm Tenure Problems

The task of determining the crucial farm tenure problems is as difficult as it is important. As Dewey said, "There is not at first a situation and a problem, much less just a problem and no situation. There is a troubled, perplexed, trying situation, where the difficulty is, as it were, spread throughout the entire situation, infecting it as a whole. If we knew just what the difficulty was and where it lay, the job of reflection would be much easier than it is. As the saying truly goes, a question well put is half answered. In fact, we know what the problem exactly is simultaneously with finding a way out and getting it resolved. Problem and solution stand out completely at the same time. Up to that point our grasp of the problem has been more or less vague and tentative."[1]

That land-tenure research workers' grasp of tenure problems has also been vague and tentative has been made clear by Salter, who reviewed published research in this field between 1910 and 1945. He concluded:

> In the first place a good deal of the work is not of the problem-solving type. Much effort has been given to describing existing lease forms and republicizing census data, not with any purpose of revealing sources of difficulty or finding solutions, but merely to make simple information available to any who might be interested in it. Only in [H. C.] Taylor's earliest work and a few rare instances since, is there any evidence that investigations were specifically conducted for the purpose of clarifying difficulties and uncovering experiments in which these difficulties had been overcome.

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[1] John Dewey, How We Think (Boston: D. C. Heath and Co., 1933), as presented by Randall, Buchler, and Shirk in Readings in Philosophy (New York: Barnes and Noble Inc., 1946), p. 187 (italics in original).

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> On the contrary . . . there has been an increasing predominance of reports with no action problem posed, no problem explored and no problem solved.[2]

Salter goes on to say "it should be recognized that research has its roots in problematic situations; that is, it exists because of conditions under which there is doubt as to what people should do because there is conflict between the purposes they are striving to achieve and the consequences they are experiencing. There is need for sharper attention to the preliminary exploration and clear definition of problems--that is, to the statement of doubts and conflicts . . . The next step is to encourage the functional use of hypotheses. Hypotheses are suggested alternative lines of action that will lead to the achievement of purposes. Their function is to direct the search for evidence . . ." (p. 252).

Despite the favorable reaction to Salter's criticism and despite the enthusiasm of tenure-research workers for John Dewey's ideas about the necessity of exploring troubled, perplexing and difficult situations to discover the problem, there remains much doubt and uncertainty about the nature of land-tenure problems. For example, in 1955 the Interregional Land Tenure Research Committee, in its "Gray Report," suggests that inefficiency, instability and inequality in resource use are the relevant social problems; and the objective or the goal is to remove them. If this is true, "then the functions of tenure arrangements become the creation of necessary incentives and means conducive to (1) efficient resource use, (2) stability of resource productivity, and (3) equality of access of resources among individuals."[3]

These goals were sharply criticized by Bogholt who asked, "What is the basis. . .for the claim that the situation described as desirable as an end is really so? . . .How was it come by? By what special methods? What assurance is given, open to the test of others, that the ends set up are desirable, as is asserted?" He goes on to say, "the genuine judgment as to what is desirable is the outcome of an inquiry which is instigated by an experienced lack or insufficiency in a unique situation. The lack or insufficiency, let us call it a gap or discrepancy, is not something that

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[2]Leonard A. Salter, Jr., A Critical Review of Research in Land Economics, (Minneapolis: University of Minnesota Press, 1948), p. 230. See also Joseph Ackerman, "Status and Appraisal of Research in Farm Tenancy," Journal of Farm Economics 23 (1941), pp. 229-30.

[3]Interregional Land Tenure Research Committee, Agricultural Land Tenure Research, Scope and Nature: Reappraisal, 1955, The Gray Report, Farm Foundation (Chicago, 1955), p. 2.

is determined by comparing the existent with an ideal. It is a situation directly experienced."[4]

The Gray Report was revised in 1962 by Ottoson, Wunderlich and Diesslin who found that efficiency, stability and equality as tenure goals left much to be desired. "In the first place there can be goals other than efficiency, stability and equality of access; such things as economic progress, distribution of income, political freedom, freedom from economic restraint, balanced growth . . . security and justice come to mind . . . In the second place, and perhaps even more important from the standpoint of research, the three objectives suggested in the Gray Report are so general, so obscure, that they are of little use empirically."[5]

Although 26 areas of suggested tenure research were then outlined, the authors "make no pretense this 'listing' approach is the well-calculated result of a logically constructed system of objectives" (p. 4).

Because of the confusion in identifying the major tenure problems, objectives or goals, it is fitting that the first objective of a farm-tenure research project should be to determine the problems or to "identify the objectives and purposes that people expect tenure arrangements to serve" before it attempts to "appraise alternative tenure systems and institutions which impede or expedite achievement of objectives" or "examine in detail specific arrangements with consideration given to how well they serve the aspirations of people involved and the impact on resource use and community life."[6]

II. The Four F's and Cash Leasing in England

What was the crucial problem in the tenure situation of English tenants? Ashby notes that during the nineteenth century, English landlord-tenant problems centered around what were then known as "the three F's: Fair rents, fixity of tenure and freedom of cropping, to which was added

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[4]Carl M. Bogholt, "Value Judgment and Land Tenure Research," Land Tenure Research Workshop, Farm Foundation (Chicago, 1956), pp. 133-34.

[5]Howard W. Ottoson, Gene Wunderlich, and Howard G. Diesslin, Land Tenure Research, Scope and Nature, U.S. Department of Agriculture, ERS-119 (1962), pp. 2-3.

[6]These are the three objectives of South Dakota Agricultural Experiment Station Research Project 371, approved 18 June 1962, a contributing project to NC-53 which has similar objectives.

later freedom of sale of produce. . . Demand on the part of tenants for fixity of tenure. . . or alternately provision for compensation for improvements made by the tenant became necessary as agricultural practices developed and traditional systems no longer sufficed."[7]

It would be a mistake, however, to believe that these problems were unique to the nineteenth century. Two centuries earlier Walter Blith, English Improver Improved (1652) declared, "If a Tenant be at ever so great paines or cost for the improvement of his Land, he doth thereby but occaision a greater Rack upon himself, or else invests his Land-Lord into his cost and labour gratis, or at best lies at his Land-Lord's mercy for requitall; which occaisions a neglect of all good Husbandry. . . Now this I humble conceive may be removed, if there were a Law Inacted by which every Land-Lord should be obliged, either to give him reasonable allowance for his clear Improvement, or else suffer him or his to enjoy it so much longer as till he hath a proportionable requitall."[8]

Alternatively these early English landlords and tenants were being urged to make 21-year leases, such as were being used in Flanders, which specified that "whatscever four indifferent persons (whereof two to bee chosen by one and two of the other) should judg the Farm to bee improved at the end of his Leas, the Owner was to paie so much in value to the Tenant for his improving it."[9]

Long-term leases eventually became common in certain parts of England, but rapid changes in prices caused them to fall into disfavor with both landlord and tenant. The question of compensation for unexhausted value still arose at the end of the term, and the tenant who for years had been secure became progressively less secure as the term approached its end. Some tenants who did not expect the lease to be renewed used the last years to "milk" the land. Another reason for the decline in the use of long-term leases may have been the decline in the need for major farm improvements such as clearing and draining or the assumption of this

[7]A. W. Ashby, "Farm Tenancy," Encyclopaedia Social Science, vol. 6 (1931), p. 121. A fourth F, freedom to improve, was probably already achieved by the time the three F's became a popular expression of tenure goals. In any event, freedom to improve was the first of the major tenure goals achieved.

[8]Lord Ernle, English Farming Past and Present, rev. (London: Frank Cass and Co. Ltd., 1961), p. 113.

[9]Sir Richard Weston, Discours of the Husbandrie used in Brabrant and Flanders (1645; pub. by Samuel Hartlib in 1650 and 1651), as quoted by Ernle, English Farming, p. 113.

responsibility by the landlord. With no major improvements to be made, about all the landlord wanted of the tenant was the rent and maintenance of the property--requirements as easily met under a short-term lease as a long one. So long as these conditions were met, the tenant may have enjoyed a strong feeling of security.

Ashby noted that "tenancies from year to year, in practice for one year and then from one year to another until notice to terminate is given by one of the parties, are theoretially short term leases. But in practice agreements for tenancies from year to year may subsist for long periods. There are well authenticated cases of continuous occupation of one farm by one family for two or three generations under such agreements in England. . . On the whole it is probable that tenancies subsist for longer periods under the year to year agreements than under leases for periods of years" (p. 120).

It would be a mistake, however, to assume that long occupancy always results in a feeling of secure tenure. Much depends upon the nature of the landlord and customary practice. When the landlord is a permanent estate consisting of many farms and has an established record of fair dealing with tenants, never putting them off except for failure to pay the rent or flagrant abuse of the property, the tenants are as likely to feel secure as if they had a long-term lease. But when the landlord owns only one or two farms, has little ability to deal with tenants, lacks financial security, is quite old and has heirs who cannot be expected to continue the lease, the short-term tenant will probably feel insecure. Under these circumstances even a long-term lease might not be of much help because the tenant may feel that the landlord will find a reason to break the lease if it is to his advantage to do so. As Thomas pointed out "all landlords were not good landlords, and a traditional system untrammeled with legal restrictions gave scope for the bad landlord as well as opportunity for the good landlord. In particular, the system suffered from three drawbacks known to students of the subject as the 'three F's' standing for the absence of fair rents, fixity of tenure and free sale."[10]

To make the general practice uniform, legislation was first adopted in 1851 which gave the tenant the right to remove certain improvements, provided he had received the written consent of the landlord before building them. In 1875 an Agricultural Holdings Act was adopted which permitted the outgoing tenant to claim compensation for the unexhausted value of certain improvements that he had made, but the law could be, and often was, circumvented. In 1883 the provisions of the law were made compulsory so that all tenants when quitting a farm could claim compensation for the

[10]Edgar Thomas, "Tenure of Agricultural Land in Britain," Family Farm Policy, ed. Ackerman and Harris (Chicago: University of Chicago Press, 1947), p. 165.

value of unexhausted improvements to an oncoming tenant.[11]

Two goals, "fixity of tenure" and "freedom of cropping," were achieved in 1906 when Parliament passed an act which permitted the tenant to claim compensation for unjustified disturbance and gave him, subject to some restrictions, freedom to follow a system of farming of his own choosing.

In 1920 the third goal, "fair rents," was largely achieved by another act permitting the tenant to demand arbitration of the rent to be paid. If the landlord refused to arbitrate, the tenant could leave the farm and claim compensation for unjustified disturbance just as if the landlord had given notice. This law also permitted the tenant to claim compensation for farming practices superior to those of the community.

Parliament consolidated all these laws into the Agricultural Holdings Act of 1923. Further changes were made in the Agricultural Act of 1947 and the tenure provisions were again consolidated in the Agricultural Holdings Act 1948, making "the once servile tenant into the spoilt darling of the legislature. . . by putting land tenure on a basis which, in practice, made a solvent sitting tenant irremovable and kept rents substantially below their open market level. Subsequent political trends made adjustments in favor of the agricultural landlord inevitable, and the first installment was made in the Agricultural Act of 1958."[12]

Watson had earlier called attention to the fact "that the law has been repeatedly changed to the advantage of the tenant. It is no matter for surprise that the tenants now no longer ask for long leases; the common tenancy--which runs from year to year until one party or the other gives a year's notice to terminate--gives all the security that could be reasonably demanded. Again it is not surprising that British farmers (who, in general, have never had much ambition to own their farms) are now definitely adverse to ownership. A farmer will rarely buy if he can rent the kind of a farm he wants. The main anxiety now is whether the landlord will be able or willing, for the future to fulfill what are regarded as his normal responsibilities--the maintenance and modernization

[11] This and the following discussion of English laws is based on "Improvement of the Tenant Status in England," Farm Tenancy Report of the President's Committee (Washington, D. C.: U.S. Government Printing Office, 1937), pp. 72-73.

[12] O. R. McGregor, "Agriculture in an Industrial Society," in Ernle, English Farming, Past and Present, 1961 (Chap. IV of Introduction), p. cxliii.

when necessary of the farmhouse, hired men's house, barns, farm roadways and drainage systems."[13]

Thus the law which Walter Blith called for in 1652 was finally enacted in 1883, and in subsequent legislation the other F's have been fully achieved. Indeed they appear to have been over achieved so that the landlords, rather than the tenants, now have a serious tenure problem. Be that as it may, the passage of the tenancy legislation indicates that the four F's were major objectives or goals of farmers.

III. The Four F's and Owner-Operation in the United States

During the two centuries that the English tenant was acquiring the four F's, his cousin in America was achieving the four F's and more by fee simple ownership. The attempts to reproduce medieval feudalism in the New World by making large grants to royalty failed simply because land was too easily obtained in other ways. Therefore, men who ventured to the Colonies did not voluntarily settle on the feudal holdings that were set up. Attempts to collect quitrents also failed. Why would anyone agree to pay such rents when land was almost free for the taking? Why would anyone become a tenant on unimproved land, then after clearing the wilderness lose or share the returns with a landlord who had contributed little or nothing?

Lands granted to the New England Colonies were in turn granted to groups of settlers who created townships and divided the land by lot according to need and productivity. This system was based on the English manorial system, but the manorial head was replaced by a democratic town government. Instead of rents, taxes were paid; no doubt the question of "fair taxes" replaced the question of "fair rents." Because the settler had fixity of tenure, freedom of improvement, and freedom of cropping, the Old World problems did not arise.[14]

The only fully developed manorial system arose in the middle colonies that later became New York, Pennsylvania, New Jersey, Maryland, and Delaware. This system was started by the Dutch in New York--especially along

[13] James A. S. Watson, "Land Ownership, Farm Tenancy and Farm Labor in Britain," Agricultural History 17 (1943), p. 77.

[14] E. E. Edwards, "American Agriculture--the First 300 Years" in Farmers in a Changing World, U.S. Department of Agriculture, Yearbook of Agriculture (1940), pp. 175-76; Murray R. Benedict, Farm Policies of the United States, 1785-1900 (New York: Twentieth Century Fund, 1953), p. 6.

the Hudson River--but these manors were almost deserted when the British took over in 1664. The lands that are now New York, Pennsylvania and Delaware were granted to the Duke of York, a younger brother of the King. In 1680 the Duke leased Pennsylvania and Delaware to William Penn for 10,000 years.

The Duke's effort to introduce the quitrents (cash payments as a substitute for labor on the Lord's holdings) was unpopular and poorly enforced. Nonetheless, quitrents continued to be a source of irritation, even violence, until the middle of the nineteenth century. Penn's efforts to establish manorial systems were somewhat more successful partially because the quitrents were only a penny an acre. The New England system and the headright system were also used and, of course, with virtually unlimited land available, these systems provided unbeatable competition for the manors.

In Virginia a headright of 50 acres could be secured by anyone who "adventured" himself to the Colony. Soon this privilege was extended to every member of the family and finally to anyone who would pay one to five shillings for the right. The headright could be located on any available land, and of course, the best was chosen. At the beginning of the eighteenth century other methods of land disposal were used by the southern Colonies. Small grants with quitrents were used. Some groups of settlers established semi-autonomous communities known as "hundreds."

The scarcity of labor also made it difficult for large landed estates to develop. At least four of five free white men in the Colonies were farmers on their own land. They were not interested in developing land for others. Only the introduction of Negro slaves made the large estates and plantations profitable and possible. These plantations resembled manors except that they were worked by slaves. Once created, they tended to be kept intact in Virginia by primogeniture and entails until 1776 when Jefferson succeeded in changing these laws.[15]

The abolition of primogeniture and entails, started by Jefferson in Virginia, soon spread to the other states. Both primogeniture and entails were prohibited by the Northwest Ordinance of 1787 which specified that property of all "dying intestate, shall descend to, and be distributed among their children, and the descendants of a deceased child, in equal parts."[16]

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[15] E. E. Edwards, Jefferson and Agriculture, U. S. Department of Agriculture Agricultural History Series no. 7 (1943), p. 54.

[16] H. S. Commager, Documents of American History, 5th ed. (New York: Appleton-Century-Crofts, Inc., 1949), p. 128.

Although the outlawing of primogeniture and entails did not prevent estates being held together by will and trusts, the action clearly indicates that the farmers of the time chose to solve the problems of the four F's not by long leases, compensatory clauses and legislation, but by ownership. Although the problems and goals were much the same, the English tenant took the road to tenancy improvement and his American cousin the road to ownership.

If the manorial system had succeeded, the problems of the four F's probably would have been as severe in this country as in England. But the scarcity of labor and the abundance of land made the purchase of land for resale to farmers in fee simple a more attractive business than leasing. For the American farmer the major concern was with "fair sale" of land, fair credit terms, and eventually free land which gave him the remaining three F's--fixity of tenure, freedom of improvement and freedom of operation.

Starting in 1787, one land credit scheme after another was tried and found wanting. By 1820 credit was abolished in favor of cash sales with a minimum price of $1.25 per acre. In 1841 the Preemption Act was passed which allowed those who settled on the public domain ahead of the surveys to have first opportunity to acquire title to 160 acres when it was offered for sale at the minimum price. In 1854 the Graduation Act provided that land which had been on the market 10 years could be sold for $1.00 an acre, 15 years for $.75, 20 years at $.50 and so on. Then in 1862, after a long struggle for "free land," the Homestead Act of that year virtually gave 160 acres of land to any settler after five years of residence or permitted him to commute this requirement by paying $1.25 to $2.50 per acre. The original Homestead Act was followed by the Desert Land Act, the Timber Culture Act, and the Timber and Stone Act. All these acts made it possible for the settler to secure the additional land needed for an economic unit in the West.

Unfortunately the settlers had to learn the hard way that free land was not inexhaustible and that what was free to one generation was costly for the next. As a result, farm tenancy increased from 25 percent in 1880, to 35 percent in 1900, and to 37 percent by 1910. Sharp increases in land prices doubled the need for credit for land purchases, and agitation for more credit resulted in a return to governmental credit for farm ownership. Strong pressures resulted in the passage of the Federal Farm Loan Act in 1916, which established the Federal Land Banks. One of the strongest arguments for this Act was that it would give deserving tenants an opportunity to become owners; but from 1917 to 1921 only 18 percent of the loans were used to purchase land, and the figure did not rise above 20 percent until 1937.[17]

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[17] William G. Murray, "Governmental Farm Credit and Tenancy," Agricultural Finance, 2nd ed. (Ames: Iowa State College Press, 1947), pp. 341-2.

That farmers and their leaders were greatly concerned about the problem of maintaining the four F's by owner-operation is indicated by the number of States that enacted credit measures between 1913 and 1915. These were Massachusetts, Utah, Wisconsin, New York, Missouri, Oklahoma, Montana, Minnesota, and the two Dakotas.

The depression of the 1930s and the extensive farm-mortgage foreclosures caused the federal government to pass the Emergency Farm Mortgage Act of 1933 which provided for Land Bank Commissioner Loans permitting loans after 1945 up to 65 percent of the normal agricultural value of the farm. In 1937 Congress passed the Bankhead-Jones Farm Tenant Act which, according to Murray, "was a clear-cut mandate of Congress to use Government credit to aid tenants in purchasing farms" (p. 319). A unique feature was that these loans could be made for up to 100 percent of value of the farm as certified by a county committee of farmers. Lack of funds and the limitation of loans to farms of average size or smaller has kept the program from significantly affecting the farm-tenure situation, but its existence does emphasize the strong demand for the achievement of the four F's by owner-operation.

IV. Landlord and Tenant Opinion Regarding the Four F's

The evidence available from farm tenure surveys leaves much to be desired. None of the studies reviewed below had as its sole objective the determination of what problems frustrate farmers. Indeed, in most, evidence of the nature of the problem is a side product of other purposes.

Questions designed to determine a farmer's frustrations and the cause of those frustrations are difficult to construct. Even when good questions have been designed, the farmer's answers will vary with his experience and intelligence. This is true because it is one thing to experience difficulty and be frustrated and quite another to be able to identify and express the cause of the difficulty. The survey results, however, do give some evidence of the nature of farm-tenure problems.

That tenants want more fixity of tenure is suggested by their desire for longer-term leases even though the strength of this desire has not been satisfactorily measured. In Nebraska, Lambrecht and Wallin found that of 54 tenants interviewed, only 7 percent preferred one-year leases, whereas 17 percent preferred three to four-year leases and 76 percent, five-year leases. In contrast, 70 percent of the landlords interviewed preferred a one-year lease.[18]

[18] G. H. Lambrecht and L. W. Wallin, Farm Tenancy in Box Butte County, Nebraska, Nebraska Agricultural Experiment Station Bulletin 336 (1942), pp. 23-24 and Table 19.

Similar results were secured when 90 central South Dakota tenants were asked (1) "What is the length of your present lease?" and (2) "What length of lease do you prefer?" Although 95 percent had one-year or year-to-year leases, 66 percent preferred three-year terms or longer, and 35 percent five-year terms or longer.[19] These answers were in sharp contrast to replies from 267 South Dakota landlords. Of these, 83 percent used a one-year lease and 78 percent said they preferred the short term (p. 6).

In 1961, questionnaires were sent to 250 landlords and 500 tenants in Brookings County, South Dakota. Replies were received from 85 landlords and 130 tenants. Only 53 percent of these landlords said that they believed long-term leases should be made, whereas 84 percent of the tenants preferred long terms. It is also possible that some of the landlords who said they favored long terms may have confused long terms with long occupancy, which they favor--provided a good job of farming is done and a fair rent is paid. In any event, the difference in opinion is still considerable.[20]

Tenants seem to feel fairly confident of long occupancy--perhaps believing that they can keep the landlord satisfied that they are doing a good job and paying a fair rent. For example, 60 percent of the tenants in Moody County, South Dakota, said they felt they had 10 chances out of 10 of keeping their present farms for the next 5 years, even though many of these tenants had one-year leases and preferred longer terms. Only 26 percent said they had a 50-50 chance or less of keeping the farm for the next five years. Moreover, only 17 percent thought that a five-year lease would increase their chances of keeping the farm for the next five years. The rest (83 percent) thought it would not make much difference.[21]

Why then do tenants prefer longer-term leases? A possible answer is that they want more freedom of operation or management than they have under short terms. If this is true, why do farm landlords resist the tenants' desire for more freedom and independence? Asked why the short-term lease was customarily used, 65 percent of 267 South Dakota landlords

[19] R. L. Berry, Share Rents and Short-Term Farm Leases, South Dakota Agricultural Experiment Station Circular 117 (1955), p. 5, Tables 1 and 3.

[20] R. L. Berry, Farm Tenancy Problems in South Dakota, South Dakota Agricultural Experiment Station Bulletin 510 (1963), Table 21, fourth question.

[21] R. L. Berry and V. E. Bau, Tenant Interest in Long Term Cash and Flexible Cash Leases, South Dakota Agricultural Experiment Station Bulletin 480 (1959), p. 16, Tables 9 and 10.

replying chose the statement, "Because the short-term lease keeps the tenant on his toes since he knows you can get another tenant if he does a poor job."[22] In the 1961 study, 67 percent of the landlords and 77 percent of the tenants indicated that they believed the following statement was true: "The main reason why the short-term lease is customarily used is to make sure that the tenant does a good job of farming and pays a fair share as rent."[23]

Because the share-rent lease was being used by almost all of these landlords, it is not difficult to understand the reluctance to grant long-term leases that would permit tenants to farm in a way that might seriously reduce rents. After all, the short term is the landlord's best insurance against a tenant who does a poor job and pays a poor rent.

V. Land-Tenure Research Workers and the Four F's

Although research bulletins on farm tenancy between 1910 and 1945 had little to say about tenure problems and goals, some special reports and journal articles were beginning to discuss them.

In 1937 the President's Committee recognized ownership as the historic means of achieving security rather than being an end or goal in itself. Therefore, it urged not only more credit for ownership but also legislation similar to that in England to give the tenant more security of tenure and more freedom of improvement. Security of tenure and freedom of improvement thus appear to be the immediate goals sought. Stability of rural life, soil conservation, conservation of levels of living, and economic stability and security, however, were also discussed. It is not clear whether these latter were regarded as tenure goals or as general goals of society that were only incidentally related to tenure.[24]

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[22] Berry, Share Rents, pp. 10-13, Table 7. The other alternatives listed were: (A) Because long-term leases are not as binding on tenants as they are on landlords, (B) Because the one-year lease gives the landlord a chance to increase the rent as his expenses rise, (C) quoted above, (D) Other. An open-end pretest indicated that these answers were the most popular.

[23] Berry, Farm Tenancy Problems, Table 21, last question.

[24] Report of the President's Committee, Farm Tenancy (Washington, D. C.: U.S. Government Printing Office, 1937), pp. 9-18.

Henry C. Taylor, a member of the President's Committee, pointed out that fair rent, security of tenure, and freedom of operation were goals of the past and raised the question as to what degree these should be sacrificed to achieve other goals of society.[25]

Maddox listed four outstanding goals of the major national programs. One of these was "security, opportunity and personal integrity of nonland-owning agriculturalists, such as tenants and farm laborers." Another was to maintain owner-operation. Whether the security referred to is economic or tenure-related was not made clear.[26] Much clearer was Schickele's statement that "security of tenure and opportunity to exercise initiative and develop managerial competence on the part of the tenant are cornerstones of an efficient tenancy system which are deplorably lacking in the corn belt." To achieve these objectives, compensation for the tenant's unexhausted improvements and automatic continuation clauses with longer-term notices were recommended for study.[27]

In contrast, Wiley believed that the tenure problem was one of increasing the farmer's equity whether he be a tenant or an owner. Larger farms and greater efficiency thus were regarded as means to greater equity. Nonetheless he called for improvements in landlord-tenant relationships, "thereby leading to greater security of tenure."[28]

Brandt said our society calls for a tenure system that will foster economic efficiency in such a way that an optimum of creativity, and individual freedom and security can be attained. "Greater security of tenure and compensation for improvements promises to assimilate the functioning of tenancy to that of owner operation and to lead to longer occupancy, more conservationist husbandry and improvement in durable land improvements. The social and professional standards of tenants will gradually be raised. . . ."[29]

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[25] H. C. Taylor, "Land Tenure and Social Control of the Use of Land" in Proceedings of the Fifth International Conference of Agricultural Economists (1938 pp. 140-165.

[26] J. G. Maddox, "Land Tenure Research in a National Land Policy," Journal of Farm Economics 19, no. 1 (1937), p. 106.

[27] Rainer Schickele, "Tenure Problems and Research Needs in the Middle West," Journal of Farm Economics 19, no. 1 (1937), pp. 118-22.

[28] C. A. Wiley, "Tenure Problems and Research Needs in the South," Journal of Farm Economics 19, no. 1 (1937), pp. 133, 138.

[29] Karl Brandt, "Toward a More Adequate Approach to the Farm Tenure Program," Journal of Farm Economics 24, no. 1 (1942), pp. 208, 225.

To Hoffsommer, control in tenure relations is more fundamental than security of tenure. "Control implies the ability to do what one wants to do--to be either venturesome or conservative," he declared.[30] Thus control implies freedom of short-run operation and long-run improvement. Without security of tenure, such control or freedom is not likely to exist.

Although Hammar disagreed with Brandt about the importance of the tenure problem, he did little to clarify the point. He decried the land-tenure ideal or goal of owner-operation and argued that if efficiency in the use of human resources were achieved, the tenure problem would largely solve itself.[31]

In 1943 Timmons stressed the importance of distinguishing between ends and means in farm-tenure goals. He declared that "the following six goals . . . are posed as the ends of tenure policy towards which means should be directed . . . .

(1) Freedom to develop one's resources and to realize his inalienable rights to life, liberty and happiness.

(2) Widely distributed rights in land (control over land resources) to provide the physical resources with which to work and enjoy life.

(3) Security in the future possession of present landed rights.

(4) Stability of rural institutions including the school, church and local government.

(5) Efficiency of production directed towards the maximization of the produce from the resources in which rights are held.

(6) Conservation of resources in which rights are held or over which control is exercised."[32]

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[30] Harold Hoffsommer, "Progress of Tenure Groups," Journal of Farm Economics 23, no. 1 (1941), p. 210.

[31] Conrad H. Hammar, "The Land Tenure Ideal," Journal of Land and Public Utility Economics 19, no. 1 (1943), pp. 78-81.

[32] John F. Timmons, "Land Tenure Policy Goals," Journal of Land and Public Utility Economics 19, no. 1 (1943), pp. 167-79.

When the North Central Land Tenure Research Committee reviewed available research data the following year, it concluded that (1) adequate farm income, (2) security of tenure and (3) opportunity for personal and community development were necessary objectives, or goals, that were basic to constructive tenure policies.[33]

In the same year a committee of the Association of Land Grant Colleges and Universities agreed that owner-operation should remain the tenure pattern, but concluded that "the farmer's security and freedom in the use of land and his share in farm income are of more significance than whether he is called an owner, tenant or laborer."[34]

In 1945, the U. S. Department of Agriculture declared that "public policy ought to encourage the development of owner-operated family farms and be directed towards these primary objectives:

(1) An equitable distribution of farm income.

(2) Conservation and development of farm land and buildings.

(3) Effective farm work and efficient production . . . . .

(4) Wide distribution of the control over farm land . . . . .

(5) Maximum freedom of action for individuals . . . . .

(6) Equality of opportunity, dignity, and self respect for all tenure groups.

(7) Reasonable security for the individual in his possession of rights in land.

(8) A wholesome, well-integrated and stable community."[35]

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[33] North Central Land Tenure Research Committee, Improving Farm Tenure in the Midwest (North Central Regional Publication no. 2), Illinois Agricultural Experiment Station Bulletin 502 (1944), pp. 146-49.

[34] Postwar Agricultural Policy, Association of Land Grant Colleges and Universities (1944), pp. 30-31.

[35] Farm Tenure Improvement in the United States, U. S. Department of Agriculture Interbureau Committee on Postwar Programs, mimeographed preliminary (1945), p. 56.

One year later the land tenure committee of the Northern Great Plains Agricultural Advisory Committee accepted (1) adequate income, (2) security of tenure, (3) stability of rural life, (4) land conservation and development, and (5) more owner operation as "an effective means of furthering other tenure objectives."[36]

At the International Conference on Family Farms held in Chicago in 1946, Belshaw declared that a desirable tenure system should

(1) prevent waste or encourage conservation,

(2) provide the opportunity or freedom of farming and improvement,

(3) encourage efficient sized farms,

(4) encourage entry of well-qualified farmers regardless of their capital,

(5) provide security of tenure,

(6) avoid speculative booms and bursts in land prices,

(7) encourage wage rates comparable to other occupations, and

(8) increase stability of net income.[37]

At the same conference a committee chaired by E. B. Hill, on the "Place of Ownership and Tenancy," declared that "the weak spots in farm tenancy . . . are (a) insecurity of tenure; (b) inadequate farms--farms too small, soil productivity low, farm improvements not maintained; (c) lack of managerial control by the tenant; (d) incompetent management; (e) inadequate family incomes; (f) poor housing; (g) lack of tenant participation in community affairs; (h) lack of reimbursement for improvements made and for damage done by the tenant."[38]

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[36] Improving Farm and Ranch Tenure in the Northern Plains, Northern Great Plains Agricultural Advisory Council Report 1, Montana Agricultural Experiment Station Bulletin 436 (1946), pp. 4-5.

[37] Horace Belshaw, "Land Tenure and the Problem of Tenure Reform in New Zealand," Family Farm Policy, ed. Ackerman and Harris (Chicago: University of Chicago Press, 1946), pp. 193-99.

[38] E. B. Hill and others, Family Farm Policy, p. 425.

Another committee, chaired by Hoffsommer on "Measures to Improve Tenure Conditions of Family Farms," listed as problems "(1) security and stability of occupancy, (2) conservation and improvement of farming, (3) structural improvements and other provisions for tenants, (4) rental rates, and (5) cooperation between owner and tenant."[39]

A third committee on "Government and Tenure Improvement," chaired by Benedict, found that legislation was needed to

(1) Compensate the tenant for the value of his unexhausted improvements and penalize him for his waste, damages, or failure to meet other obligations.

(2) Provide security of tenure through automatic renewal and compensation for unjustified disturbance.

(3) Provide reasonable freedom of cropping.

(4) Protect the tenant against excessive rentals.

(5) Provide adequate housing.[40]

Harris and Ackerman summarized the goals of Belshaw and the committees of the conference in twelve points, but in discussing farm tenancy they said, "lack of managerial control on the part of the tenant is a major shortcoming everywhere, although admittedly more pronounced in some places than others. This has an adverse effect upon securing maximum production efficiency for the tenant is not free to choose a balanced combination of enterprises, he is handicapped in the development of livestock, and his short-time viewpoint forces him to have little concern about planning crop rotations and following conservational practices . . . where the tenant is not assured of occupancy long enough to get the benefit from capital developments or where he has no right of compensation for improvements when he leaves the farm," he is afraid to improve for fear of losing the farm or being charged a higher rental.[41]

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[39] H. Hoffsommer and others, Family Farm Policy, p. 441.

[40] Murray R. Benedict and others, Family Farm Policy, pp. 488-89.

[41] Marshall Harris and Joseph Ackerman, "Interpretive Summary of the Conference," Family Farm Policy, pp. 25-26.

Harris listed the following tenure objectives or goals at the Caribbean Land Tenure Symposium in 1946:

1. Responsible freedom of personal action.
2. Equality and dignity of all tenure groups.
3. Secure possession of rights in land.
4. Equitable distribution of rights in property.
5. Conservation and development of physical resources.
6. Highly efficient utilization of productive resources.
7. Equitable distribution of income.
8. Well integrated community life.[42]

A year after the International Farm Family Conference, Heady wrote an article on leasing which appeared to question most of the problems and goals developed by the conference.[43] To Heady the major problem of society, and certainly of agriculture, is inefficiency. He cited imperfect leasing systems as one cause of agricultural inefficiency and formulated rules to overcome the imperfections. These rules were intended to provide the tenant with freedom to allocate resources as prices and costs direct in the interest of greater efficiency.

That the lack of the four F's may not affect efficiency was indicated by several studies which compared share tenants and owner-operators. Little or no evidence was found that share tenants farmed less efficiently than did owners.[44]

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[42]Marshall Harris, "Objectives of Land Tenure Policy," Readings on Agricultural Policy, ed. O. B. Jesness (Philadelphia: Blakiston Co., 1949), p. 383. Reprinted from Caribbean Land Tenure Symposium, Caribbean Commission (Trinidad, 1946), pp. 30-48.

[43]Earl O. Heady, "Economics of Farm Leasing Systems," Journal of Farm Economics 29, no. 3 (1947). This article was later slightly revised and republished as Chap. 20 in his Economics of Agricultural Production and Resource Use (New York: Prentice-Hall, Inc., 1952).

[44]See D. Gale Johnson, "Resource Allocation Under Share Contracts," Journal of Political Economics 58 (April 1950), p. 118. (His evidence consisted mainly of a comparison of net cash and net share rents from 1925 to 1946.); E. O. Heady and Earl W. Kehrberg, Relationship of Crop-Share and Cash Leasing Systems to Farming Efficiency, Iowa Agricultural Experiment Station Bulletin 386 (1952), pp. 635, 661; Walter G. Miller, Walter E. Chryst and Howard W. Ottoson, Relative Efficiencies of Farm Tenure Classes in Intra Firm Resource Allocation (North Central Regional Publication 84) Iowa Agricultural Experiment Station Research Bulletin 461 (1958), pp. 334-5; and W. L. Gibson, Jr., Renting Farms in Southside Virginia, (Southeast Land Tenure Research Commission Publication 38), Virginia Agricultural Experiment Station Bulletin 523 (1961), pp. 30-34.

Contrary to his expectations, Sanderson found that in the adjoining deep loess areas of Iowa, Missouri, Nebraska and Kansas, crop-share tenants were more efficient crop producers than either owner-operators or livestock-share tenants. In overall efficiency, however, livestock-share tenants excelled, whereas there was little difference between crop-share tenants and owner-operators.[45]

In the same soil area of Nebraska, Neuman and Ottoson found that share tenants used less inputs per acre than either owner-operators or livestock-share tenants, but that crop-share farmers made about $1,200 more net farm income than owner-operators and $1,200 less than livestock-share farms.[46]

Barlowe noted that although emphasis on goals has changed with time, the central core of these goals has been the desire for

(1) a wide distribution of property rights,

(2) opportunity for every man to manage his business,

(3) adequate sized farms,

(4) efficient use of land over time, and

(5) maximum security and stability of possession consistent with good management.[47]

These may appear to be different from the four F's, but they are not. Item 1 has been achieved by the equivalent of "fair rents," i.e. "fair sale," by the government homestead laws and by fair credit terms. Item 2 is obviously the same as freedom of operation. Item 3 calls for freedom to enlarge the farm, an improvement comparable to enlarging the barn or introducing irrigation. Item 4 asks for freedom to improve over time, and Item 5 asks for fixity or security of tenure.

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[45]John T. Sanderson, "Relative Efficiency of Alternative Tenure Arrangements" (M. S. thesis, Iowa State University, 1960), pp. 71, 139 and Table 12; or see Virgil L. Hurlburt, Use of Farm Resources as Conditioned by Tenure Arrangements (North Central Regional Publication 151), Nebraska Agricultural Experiment Station Research Bulletin 215 (1964) which summarizes Sanderson's work, p. 15 and Table 13.

[46]Duane F. Neuman and Howard Ottoson, Type of Tenure, Organization and Resource Use on Farms in Southeast Nebraska, Nebraska Agricultural Experiment Station Agricultural Economics Report 32 (1964), p. iii.

[47]Raleigh Barlowe, Land Resource Economics (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1958), p. 435.

As mentioned above, the Interregional Land Tenure Research Committee, in its "Gray Report," held that "the functions of tenure arrangements become the creation of necessary incentives and means conducive to: (1) efficient resource use, (2) stability of resource productivity and (3) equality of access to resources among individuals" (p. 2). The interpretation usually placed on these three items is that they are tenure goals. Yet it appears that the three F's--fixity of tenure, freedom to improve, and freedom to operate--may be more immediate goals. The report declares that the debt-free full owner "has the greatest freedom to organize his resources and has maximum security of tenure expectations. The debt-free full owner can choose investments (enterprises) that will yield the greatest return over time with assurance that his length of tenure will permit his gaining the returns from these investments. Similarly, he is not affected by the dissociation of costs and returns between individuals. The full owner can supply as much of each factor as is economically feasible, knowing that he will receive the full return from every unit employed, whereas the tenant can employ resources only to the point where the last unit employed is equal to his share of the additional returns produced" (p. 9).

This quotation, and the discussion that follows concerning mortgaged owner-operators and tenants, make it clear that for these two groups the acquisition of more of the security of tenure and freedom of operation and improvement enjoyed by full owners is the immediate goal of research activity which perfect market theory suggests should result in greater efficiency. In essence then, the argument is the same as Heady's, and analysis suggests that fixity of tenure, freedom of improvement, and freedom of operation are the recognized immediate tenure goals.

How helpful are goals of efficiency, equality and stability as guides in giving farmers more security and freedom? One can only agree with Ottoson, Wunderlich and Diesslin that they "are so general, so obscure, that they are of little help empirically."[48] Nonetheless, the word efficiency appears frequently in their discussion of the 26 areas of land-tenure research. Efficiency, equality and stability are mentioned as objectives of research on getting started in farming. "Achieving Efficiency in Agricultural Land Use" is the first area discussed. Under this heading the authors say, "Tenure arrangements will obstruct efficiency if they do not encourage enlargement of farms to meet technological changes; do not give security of tenure that will lead to adoption of effective long range farm plans and improved farming practices; and do not give a fair division of costs and returns between the individuals involved" (p. 4).

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[48] Howard W. Ottoson, Gene Wunderlich, and Howard G. Diesslin, Land Tenure Research, Scope and Nature, p. 3.

Efficiency still appears to be the main objective, but sub-objectives appear to be fixity or security of tenure, freedom to improve by enlarging the farm, freedom to adopt other long range plans and improved practices, and determination of "the elements in the market situation that cause land prices, whether the use price in rental or value in transfer of ownership, to fail to reflect properly the productivity of land"--in short, fair rents or fair prices.

In discussing leasing arrangements (p. 8) the authors note that problems are created (1) when costs are not shared as the product is shared, (2) when discriminatory rents are charged, and (3) when short terms create insecure tenure. As the discussion of Heady's rules pointed out, the four F's are implied as objectives by these problems. Whether the achievement of these goals will result in greater efficiency is perhaps beside the point, unless one is willing to say that people should endure any frustration that does not affect efficiency--or a sore should not be of concern, no matter how irritating, unless it affects one's efficiency.

The views expressed in the 22 works published between 1936 and 1962 can be summarized:

Problems, objectives, goals or incentives	Frequency
Fixity or security of tenure	22
Freedom of improvement or long-run management	18
Freedom of operation or short-run management	17
Fair or equitable rents	10
Economic efficiency	14
Opportunity or equality (various meanings)	6
Soil conservation (improvement?)	7
Stability of rural institutions	3
Ownership (as a means to the first three items?)	5
Economic stability	3

There seems to be general agreement among these research workers that the first four items--the four F's--are important aspects of tenure that should receive attention because their lack constitutes a problem; and the goal or objective should be to provide them, if only as an "incentive" to greater efficiency--the fourth-ranked problem or goal.

A capitalistic, free enterprise society is founded on the notion that the greatest efficiency results when private firms have freedom to allocate their resources as costs and prices direct. To the extent that the four F's give farmers this freedom, it is logical to believe that efficiency may be increased. The fact that increased efficiency has not been found in several empirical comparisons of owner-operators, cash tenants and share-rent tenants, does not weaken the logic. Rather, it suggests that there may be other reasons for lack of any difference--custom, lease provision, or fear of losing the farm. But these studies do raise the

question of whether lack of efficiency is a tenure problem and whether its removal is a meaningful tenure objective or goal. If an automobile engine stalls, the problem is not one of miles per gallon of fuel, or efficiency. More likely, it is a problem of ignition or fuel supply to the engine. The precise problem--therefore the precise objective of the mechanic--is a matter to be determined rather than assumed.

Opportunity as a goal seems to have no generally accepted meaning. Sometimes it refers to opportunity to acquire fixity of tenure, sometimes to opportunity to manage the business. In either case it appears to be a synonym for one or more of the four F's.

Soil conservation as a goal suggests that farmers should have freedom to conserve as well as to improve. (These freedoms do not necessarily imply freedom to waste.) Ownership is one means of acquiring the four F's that is justly popular with farmers. Stability of rural institutions seems to be closely related to fixity of tenure. Finally, economic stability, like economic efficiency, does not appear to be a tenure problem but a problem of society as a whole.

VI. Farm-Tenure Goals of Landlords

Historically, the four F's have been stated from the tenant's viewpoint, and this view has been accepted. Yet if these tenure goals are to be achieved, they must also be attractive to farm landlords. This is true because in the United States the farm landlord is generally in a stronger bargaining position than is the tenant, especially when the landlord has a productive farm attractive to many land-hungry tenants. Unless the farm landlord can more easily achieve his goals, he is not likely to give the tenant either greater fixity of tenure or freedom of operation or improvement.

What, then, are the landlord's goals? Perhaps what is desired is an ideal lease that would give the landlord security as to the amount of rent, security as to the payment of the rent, and security as to the productivity of his property or reversionary interest. Stated from a different standpoint--the landlord wants freedom from poor farming, poor rents and poor upkeep of the farm.

What are the logical or theoretical reasons for believing that these hypothetical problems and goals of landlords may be valid? First, a landowner who proposes to lease his farm is obviously not interested in farming it himself. Nor is he interested in selling the farm. If he had this in mind, his main problem or goal would be to get a fair price. Once the price was paid, he would probably have no further economic problems or objectives with regard to this farm except what any citizen might have or as a matter of sentimental attachment.

If the landowner were to accept a partial payment of 30 percent or more and a note secured by a mortgage for the balance, his concern would be great. He would want to be reasonably sure that the new owner could farm well enough to make the payments as scheduled. In the event of default, the mortgage holder would want to be sure that the value of the property had been maintained sufficiently so that it would be worth the unpaid balance in the event that he were compelled to foreclose. Because such risk would be small, this is not usually a serious problem. However, if the landowner is selling on a land contract with perhaps a 10 percent down payment, he is likely to be more concerned about whether the buyer is a good farmer who will maintain or improve the farm, cultivate it properly, and make payments on time. Failure to maintain the farm or to make the payments could result in a serious loss for the seller.

If the landowner is interested in leasing the land--that is, in selling only the possession, use, and enjoyment of his land for a definite term in exchange for a rent--he is certainly interested in getting a good "buyer" or tenant. If a fixed cash rent is to be paid, the landlord's main concern will be security of rent, of payment, and security of the productivity of his property.

If the rent is an objectively determined flexible cash rent, which neither tenant nor landlord can affect after the lease is signed, the degree of concern remains much the same as in the fixed cash rent. Because the tenant can have a serious effect upon the landlord's reversionary estate, the landlord is much more concerned in getting and keeping a good farmer than he would be were he selling the land under any of the methods discussed above.

When the landlord elects to lease for a crop-share, the tenant becomes even more important. If he can get and keep a good tenant, he is assured a good job of improvement, a good job of management, and a fair share as rent. The problem is that frequently the tenant is deficient in one or more of these aspects. Hence the share landlord lacks (1) security as to the amount of rent, (2) security of rent payment and (3) security of his property. Cash rents eliminate the first of these problems but not the last two.

Because the share landlord is uncertain about rent, he may, and often does, specify in detail the crops to be grown, their acres, the variety of seed to be used, the kind and amount of fertilizers to be applied, the weed, insect and disease controls to be used and so on. Such activities on the part of the landlord--and the hiring of professional farm managers--are evidence of the importance of these problems and goals under share-rent leases.

Some landowners, however, are not interested in selling either their freehold or their leasehold. What they are interested in is either some kind of a partnership or an employer-employee relationship. Under some partnerships each party owns the same share of all resources. Other partnerships are less clear. Of these the livestock-share lease is an example. Often one party owns all the land and buildings and half the livestock while the other party furnishes all the power, machinery, labor and half the livestock; all costs and returns are shared equally. Whether this is a legal partnership is debatable, but certainly it must be at least a quasi-partnership, otherwise it would not seem so necessary to stress that it is a lease and that no partnership is intended.

When the crop-share landlord feels that it is necessary to dictate the farming plans in the detail suggested above, the result can only be a kind of quasi-partnership which differs from the livestock-share lease mainly in that the livestock is not shared. If, as sometimes happens, the landlord exercises full control over the farming plans, the tenant may be only slightly different from the sharecropper of the cotton and tobacco plantations of the South or the metayer in Europe. Finally, there are those landowners who hire a working manager to carry out plans for the operation of the farm. The relationship here is that of employer-employee. Unfortunately, the distinction between a leasehold and a partnership is not clear. This leads to much confusion. Does the landowner want a tenant, an employee, or both? If he wants a tenant, then it appears that his problems are likely to be insecurity as to the amount of rent, insecurity as to the payment of rent, and insecurity as to the maintenance of his property. Therefore, his major goals would be to achieve security of rent and property.

Empirical evidence supports the theory that landlords are primarily concerned about the amount of rent, the payment of their rent, and the protection of the property. For example, Pond asked 3,300 randomly selected Minnesota landlords why their last tenant moved;[49] the 22 percent who replied gave the following reasons:

		(percent)
1.	Tenant moved to (a) a better farm	23
	(b) a purchased farm	13
	(c) other work or retirement	14
	(d) illness or death	5
2.	Tenant was unsatisfactory	33
3.	Tenant failed to pay rent	8
4.	Landlord-tenant disagreement	3
5.	Other	1
	Total	100

[49] George A. Pond, Farm Tenancy in Minnesota, Minnesota Agricultural Experiment Station Bulletin 353 (1941), p. 40.

Landlord concern with good farming and fair rents is indicated by the fact that 41 percent of the tenants moved for these reasons (Items 2 and 3).

In Illinois, farm landlords attending county extension meetings chose 6 items from a list of 18 tenant characteristics.[50] The most popular choices and the percentage choosing each were as follows:

		(percent)
1.	Tenant with adequate power and machinery	71
2.	Tenant who will help build up farm	70
3.	Tenant who is willing to work	69
4.	Tenant who keeps up with new ideas	66
5.	Tenant to make small repairs and keep place neat	61
6.	Timely planting and harvesting	42
7.	Fair sharing of costs	41
8.	Clean attractive farm	36
9.	Written lease	32
10.	Cooperative planning	28
11.	Courteous and respectful treatment	25

The importance of good farming and hence good share rent is indicated by Items 1-4 and 6. The importance of maintaining the property is indicated by Items 5 and 8.

In contrast, Illinois farm tenants who attended the same meetings indicated the following preferences:

	(percent)
Productive farm	90
Landlord willing to make improvements	60
Adequate buildings	58
Modern house	56
Lease longer than one year	47
Written lease	41
Fair sharing of costs	40
Landlord willing to try new ideas	32
Courteous and respectful treatment	31
Appreciation for extra work done	25
Repayment for tenant-made improvements	20

Thus if landlords want good farmers, they need productive, well-improved farms and must provide some security of tenure, freedom to improve, freedom to operate, and fair sharing of costs.

[50] Franklin J. Reiss, "What Do Tenants and Landlords Want," Farm Management Facts and Opinions to Help You, Newsletter no. 82 (21 February 1965).

In South Dakota, a mail questionnaire was sent to 1,200 randomly chosen landlords.[51] Of the 317 who replied, 103 said that their previous tenant left at their request. The reasons given for requesting that the tenant leave were:

	(percent)
Poor manager	47
Lazy	3
Dishonest	12
Other reasons	30
No reply	8

In Oklahoma, several hundred farm landlords who attended farm landlord-tenant hearings in 1938 gave these reasons why tenants move:[52]

	(percent)
Poor farming	51
To get better farm	17
Poor income	16
Poor upkeep of property	16

The same landlords gave the following reasons for landlord-tenant disagreements:

	(percent)
Poor farming	32
Division of crops	27
Indefinite agreements	21
Destruction of property	19

These landlords also said that when they selected tenants they looked for:

	(percent)
Power and equipment	29
Honesty and dependability	28
Good past record	22
Good worker	21

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[51] R. L. Berry, Share Rents, p. 13.

[52] "Farm Landlord-Tenant Hearings," Oklahoma Extension Service, mimeographed (1938), p. 5.

In contrast, tenants said that they looked for these characteristics in selecting a landlord:

	(percent)
Better land	37
Better improvements	31
Water and pasture	20
Agreeable landlord	12

In Iowa, Timmons asked 145 tenants and 131 landlords what they looked for in each other.[53] Their replies were:

	Tenants' replies (percent)	Landlords' replies (percent)
Ability to cooperate and get along	52	21
Honesty and integrity	25	26
Farm experience	16	42
Other	7	11
Total	100	100

Again good farming and fair rents are suggested as the main goals by the replies of these landlords.

Farm lease forms are also an indication of what landlords want since commercial forms are almost always prepared for landlords rather than tenants. Some of these forms merely say that the tenant will farm as the landlord directs and some say that farming plans shall be made jointly. Others such as the model "Crop-Share-Cash Farm Lease" (AD561, March 1960), prepared and distributed by the U. S. Department of Agriculture, provide much space to specify the crops, the acres of each crop, the location of the crop, the seed variety, the kind and amount of fertilizer to be used and many other provisions. Commercial lease forms and many forms distributed by State extension services contain liens on the tenant's crops to guarantee the payment of the rent. A one-year or year-to-year term is almost invariably used to insure a good job of farming, a fair rent, payment of the rent and upkeep of the property.

Both the logic and the survey results (sketchy though they are) suggest that landlord and tenant goals may be complementary in many cases. Landlords want to get and keep good tenants who can and will take care of

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[53] John F. Timmons, Improving Farm Rental Arrangements in Iowa, Iowa Agricultural Experiment Station Research Bulletin 393 (1953), p. 83.

minor repairs and upkeep problems, do a good job of farming and pay a fair rent. Tenants want to get and keep good farms on which they can make improvements, do a good job of farming as they see it and likewise pay a fair rent. Thus it seems that there would be much less leasing were it not for the mutual or complementary goals achieved by leasing.

There are of course, many exceptions. Not all landowners and farmers would agree to these goals. Some landowners are definitely interested in keeping the management of the farm largely in their own hands and prefer to treat their tenants as partners or employees rather than as independent contractors. Sharecropping in the South is an example, but some share-rent leases are little better. Still other landlords tend to think of their tenants as partners in which both improvement and operation are joint responsibilities, as is usually the case under share-rent agreements. But even here many share-rent landlords are content to leave most of these problems to the tenant, reserving by means of the short-term lease the right to remove him if he does a poor job or fails to pay a fair rent.

The evidence suggests that the latter class includes many landlords who would heartily subscribe to the four goals. Certainly they are interested in getting and keeping good tenants for the very reason that they do not want to be concerned or bothered with problems of improvements, day-to-day management, and doubts about the fairness of the rent. But because the share tenant's management does affect the rent, the landlord often finds himself involved in the tenant's farming plans, worried about the amount of the rent, and using the short term to protect himself against flagrant abuse. Because the short term limits the tenant's security of tenure, it also limits his freedom to improve.

VII. Summary and Conclusions

The purpose of this paper was to determine if possible the major farm tenure problems and goals of both landlords and tenants. Evidence from English and American history, from tenure studies and from farm tenure research workers was examined.

English history reveals that the four F's were the relevant tenure goals that were finally made uniform by tenancy legislation after at least two centuries of effort. Today the English tenant has great security of tenure, freedom of improvement, freedom of cropping and full opportunity to seek adjustment of rents that he deems unfair. There can be no doubt as to the objectives sought because they are incorporated in the law for all to see. They may have achieved too well for the future of the leasing system, a further indication of the strength of these tenure goals--the four F's.

The American colonists were also interested in the four F's, but the abundance of raw land and the scarcity of labor made it possible for them to achieve their objective by fee-simple ownership. Investors found that there was more money in buying large blocks of land, subdividing and selling it to settlers than in holding it for leasing as was done in England.

Ownership, hence the four F's, was easily achieved in part because Congress passed numerous credit acts, the Graduation Act, the Preemption Act, the various homestead acts; and it created the Federal Land Bank system and the Farmers Home Administration, both intended to make owner-operators out of tenants.

Despite all efforts at increasing owner-operation, farm tenancy has increased to the point where more than 50 percent of the land in much of the Corn Belt is now under lease. In some areas it is as high as 75 percent. What do the landlords and tenants say that their major tenure problems are? Such evidence as is available indicates that the most important problems are the lack of the four F's--fixity of tenure, freedom to improve, freedom to operate, and fair rents.

Land-tenure research workers also seem to be in general agreement that lack of the four F's constitutes the major tenure problem. In recent years there has been much talk about efficiency, stability and equality as social goals which tenure arrangements should achieve. However, an examination of the proposed arrangements reveals that they would give the tenant fixity of tenure, by one means or another; freedom to improve by compensating him for the value of his unexhausted improvements; and freedom of operation by eliminating discriminatory rents among crops and among such resources as buildings, pasture and cropland.

Although there is much less literature on the problems and goals of farm landlords, the evidence, such as it is, indicates that the lack of security of the amount of rent, particularly under share-rent leases, is the major problem. Next comes the landlord's insecurity about the preservation of the productivity of his property. Thus the landlord's goals are to get a tenant who will do a good job of farming, pay a fair rent, and maintain the farm.

PUBLIC LAND DISPOSAL BY LEASEHOLD AND FREEHOLD IN CANADA, AUSTRALIA, NEW ZEALAND, AND THE NETHERLANDS

Paul O'Rourke

I. LAND POLICIES OF TWO CANADIAN PRAIRIE PROVINCES

Introduction

Alberta and Saskatchewan are the only Canadian Provinces which dispose of their public lands for intensive agriculture by leasehold as well as by freehold. The history, geography and land disposition policies of the two Provinces are similar.

During the years of settlement, between 1870 and 1930, the Canadian government controlled the public lands in the Prairie Provinces. Its land policy closely resembled that of the United States--making land available in fee simple and encouraging rapid settlement.

When the Dominion government relinquished the land to the Provinces in 1930, the drought and rural depression of the twenties and thirties forced the Provincial governments to reevaluate land policy. Rapid settlement gave way to conservation as a primary objective of land policy, and the farmers' lack of capital influenced the Provinces to adopt a policy of leasing the lands. Since the 1930s both Provinces have continued to lease, but with different emphasis. Alberta has stressed leasing as a temporary alternative to freeholding. Saskatchewan stressed leasing between 1945 and 1962, but in 1955 it allowed veterans who were holding leases to purchase their lands, and in 1962 all other leaseholders were permitted to purchase.

Geographically, the Provinces are each divided into three soil zones. A Brown Soil Zone in the South was once a wheat growing region, but since the drought of the 1930's, it has been primarily a grazing area. Today the public land is generally leased for grazing purposes. This region is surrounded on the north and east by a more fertile Black Soil Zone in

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which oats and barley are important crops. Here, fee simple ownership is the rule. The northernmost tier, extending to the Canadian shield, is the Grey-Wooded Soil Zone, a largely underdeveloped region suitable for legumes, oats, and barley (although not wheat) but requiring extensive clearing, breaking and drainage. This is the region where the Provincial governments lease most of their land for intensive agriculture and where their experience is most relevant for American land policy.[1]

Saskatchewan Land Policies

Saskatchewan has emphasized leasing its public lands more than any other Canadian Province. In 1953 the Saskatchewan Royal Commission on Agriculture and Rural Life justified leasing on several grounds:

1. Since virtually all of the land leased is in the Grey-Wooded Soil Zone and requires extensive government improvements, the government can recover the cost only through leasing.

2. These frontier lands are vulnerable to inflation, exceeding production increases, which would increase the tax and debt burden of individuals purchasing freeholds.

3. A leaseholder is in a much better position than an indebted owner to obtain adequate machinery and working capital and to operate a larger unit.

4. The government's conservation goals can be more easily attained on state-owned land rather than on undersized and undercapitalized private land.

5. The government leasing policy probably stimulates better private leasing arrangements and holds down private rental charges, an important consideration in a Province where almost half the private land is leased.

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[1] C. C. Spence, "Government Policy and Land Use in Western Canada in Land Economics Institute, University of Illinois, Modern Land Policy (Urbana, Illinois: University of Illinois Press, 1960), pp. 367-68; V. A. Wood, "Public Land Policy for Alberta," (Ph.D. dissertation, Department of Agricultural Economics, University of Minnesota, 1953), pp. 131-33; P. E. Polischuk, Director of Lands, Province of Saskatchewan, (letter, 20 November 1968).

6. Through its leasing program the government also helps freeholders to reach economic farm sizes by renting them small parcels of public land.[2]

The Commission's analysis of the advantages of leasing was by no means unique. What is surprising is that Saskatchewan adopted the leasing policy despite the preference, pointed out by the Commission, for private ownership in the frontier areas.

The basic explanation for the government's persistence in this policy is the lack of demand for available public lands. The high cost of improving the land in the Grey-Wooded Soil Zone, high costs of operation, low crop and livestock prices, the absence of roads and social amenities have discouraged prospective settlers in an era of urban immigration. A postwar settlement plan for veterans created some demand, but since the mid-fifties there has been virtually no demand for farmland in Saskatchewan. The main goal of the government's land disposal policy in recent years has been to create economic sizes of existing farms by leasing public lands to their operators.[3]

The settlers' main pressure on the government in recent years has been for the enlargement of their current holdings rather than for new homesteads. Until lately, the government considered 480 acres an adequate economic unit if half the unit were suitable for crop production. The Commission in 1953 noted the paucity of studies on the rate of return from agricultural lands and suggested that 240 acres of good cropland might be inadequate in the North. The government eventually acceded to the demand for increasing the maximum from 480 to 800 acres.[4] The number of leases and acres of public lands leased in 1967 by Saskatchewan follows:

	Number	Acres
Cultivation leases	2,880	398,382 (arable)
Grazing, hay leases, permits	11,247	5,738,606

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[2] Saskatchewan Commission on Agriculture and Rural Life, Report no. 5, Land Tenure: Rights and Responsibilities in Land Use in Saskatchewan (Regina, Saskatchewan: Queen's Printer, 1955), pp. 54-68.

[3] Burke G. Vanderhill, "The Decline of Land Settlement in Manitoba and Saskatchewan," Economic Geography 38, no. 3 (1962), pp. 270-73; A. M. Thomson, Director of Lands, Province of Saskatchewan (letter, 9 March 1966).

[4] C. C. Spence, Modern Land Policy, pp. 378, 381; Saskatchewan Commission on Agriculture and Rural Life, Report no. 5, pp. 88-89.

Between 1961 and 1967 there were 2,431 Provincial sales involving 521,106 acres of cultivated land.[5]

Rentals are paid primarily in cash. The government prefers this system because the sharecropper can cover up his yield and put the burden of proof on the Province. Sharecropping has declined to such an extent that the Province granted no lands on share rentals in 1966-67.

Rentals are based on the appraised value of the land, which is derived from soil productivity ratings; these in turn are converted into monetary values that fluctuate according to crop prices. In actuality, the land is appraised below market values. Each tract is re-evaluated every fifth year, and rents are generally assessed at 6 percent of the appraised value. This rate is adjustable; however, the adjustments are usually downward. The Commission in 1953 recommended more flexibility in rentals, claiming they were too high in the initial years of the lease and too low in later years. Two unusual provisions of the standard cultivation lease which benefit the tenant are:

1. An 8 percent discount if the rent is paid by December 1 of the current crop year when it is due. (Payment may be deferred until July 31 of the following year because of the quota delivery system of the Canadian Wheat Board. There is a 6 percent penalty if the rental is not paid by August.)

2. In years of complete crop failure or very low yield, a complete or partial write-off "of rent" is allowed.[6]

Since 1965, the government will sell--except for fractional land sales--only to a lessee who has held the land for at least five years and who has at least 25 percent of his acreage under cultivation. The minimum price is $20 an acre for arable land and $10 an acre for unimproved land. The government reduces the selling price by $50 for every year the lessee holds the land (up to a maximum of $500 or 10 percent of the appraisal price, whichever is greater). Purchases on time require a 20 percent down payment with the balance to be paid within 30 years.

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[5]Saskatchewan Department of Agriculture, Annual Report of the Director of Lands, 1967 (Regina, Saskatchewan: Queen's Printer, 1967), pp. 137-44.

[6]Thomson (letter, 9 March 1966); Saskatchewan Department of Lands, p. 136; "Cash Rental Agricultural Lease," Saskatchewan Department of Lands (Regina, Saskatchewan); Saskatchewan Commission on Agriculture and Rural Life, Report no. 5, pp. 88-89.

Lack of security of tenure has been a problem, although it is not nearly so severe on leased public lands as on the private lands of the Province. The standard cultivation lease now runs for 10 years. The tenant has priority over other applicants at renewal time, yet the administration of this provision in Saskatchewan has apparently caused uncertainty among lessees. The Commission in 1953 recommended a definite guarantee of the lessee's right of renewal. Ideally, it suggested abolishing the standard 33-year lease altogether in favor of a combination of an interim with a perpetual lease. The farmer would receive an interim lease until he had demonstrated his ability. Then, he would get a perpetual lease, which the Commission was convinced would guarantee security of tenure without the indebtedness handicaps that go with freeholding.[7]

Lack of compensation for improvements has also been a problem in the northern region where land development requires considerable work. Under the standard agricultural lease, the tenant clears and breaks the land. The government compensates him for his expenses up to $30 an acre which he may credit against his rent. The lessee owns the farm buildings and fencing and is entitled to compensation upon termination of his lease. A popular lease in new settlement areas is the Project Lease under which the government clears and breaks 50 acres while the tenant clears the brush piles. The tenant may not credit the cost of clearing additional land against any of the rental from these 50 acres.

A possible solution to the problem of improvements is the Veterans Lease which leads toward eventual ownership. The Province made these 10-year leases to World War II veterans as a part of the Dominion's resettlement programs. The veteran-lessee received a $2,320 loan from the Dominion government which became an outright grant if he stayed on the land for 10 years. He had to bring all arable land under cultivation within six years and was allowed remission of rent only for the first year of cultivation. After 10 years he was to purchase the land outright at a price that made allowance for his improvements. Although the Veterans Lease is largely a thing of the past, the prospect of eventual ownership largely solved the problem of lack of compensation for unexhausted improvements and the grants helped to provide needed capital.[8]

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[7]Spence, Modern Land Policy, p. 378; Saskatchewan Commission on Agriculture and Rural Life, Report no. 5, p. 90.

[8]Saskatchewan Commission on Agriculture and Rural Life, Report no. 5, p. 86.

The Commission also pointed out some weaknesses of the Province's leasing policy and offered some suggestions for alleviating them:

1. The cost of clearing and breaking the land often exceeded the $25 per acre the government paid the lessee for this purpose. The Department of Lands estimated the average cost for the Grey-Wooded Soil Zone at $26.42 an acre. Since the government was to own these improvements, the Commission suggested it pay full compensation for them. If the government decided it could not afford to pay the full cost of developing the land, the Commission wondered if the land was worth settling. Since 1953 the compensation for clearing and breaking has been raised to $30 an acre.

2. Because the lessee finds it difficult to raise capital since he can offer no land as security, the Commission recommended that the government advance him the money before he makes the improvements instead of compensating him afterwards as it does at present.

3. The Commission advised that the lessee receive compensation for such improvements as tree planting and grass seeding which are not presently remunerable. The Province, however, did not act upon this recommendation. The Commission also noted, in passing, that cooperative farms in which several farmers participated have helped to develop new land in Saskatchewan more rapidly than have farms with individual lessees.[9]

Related to the problem of improvements is the lessee's lack of capital. The Commission believed that the answer lay with the Dominion government's various loan programs, which it wanted consolidated into a proposed "Canadian Farm Credit Administration." The Commission suggested that the three-year period for repaying loans on machinery be extended, simply because machinery lasts longer than three years. It also wanted a 30-year repayment period on large government loans and allowance for prepayment of loans with commensurate interest reductions. In the private sector it urged bankers to extend more short-term credit to farmers, and it advised farmers and local communities to stop obtaining credit from retail stores and to help themselves by establishing credit unions.[10]

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[9]Thomson (letter, 9 March 1966); Saskatchewan Commission on Agriculture and Rural Life, Report no. 5, p. 86; Saskatchewan Department of Lands, p. 132.

[10]Saskatchewan Commission on Agriculture and Rural Life, Report no. 5, pp. 100-104; Polischuk (letter, 20 November 1968).

The government does not interfere very much with the tenant's farming activities. The Department of Lands rental contract does allow it to dictate a plan of tillage, summer fallow, crop rotation, weed control, and the treatment of grain or other farm produce in order to enhance productivity. In practice, however, the Department has done little to implement its contract powers. The Commission urged the government to supervise the tenant's conservation activities more closely. However, the trend has been in the opposite direction since the replacement of the crop share lease with a cash rental lease has substantially reduced the amount of supervision. The Commission also noted that many lessees were ignorant of the Province's land laws and pointed out that Britain publishes an abbreviated guide to the legislation in the form of a handbook. It also urged a more stringent settler selection process to eliminate poor farming practices. However, because of the dearth of applications for farm lands, this suggestion has proved difficult to implement.

Apart from general land policy, many tenants have been dissatisfied with delays in official approval of sales and leases resulting from the high annual turnover rate of local agents of the Lands Department.[11]

In conclusion--since northern Saskatchewan is a fringe area necessitating extensive improvements, experiences there may have some relevance for the Western United States.

Alberta Land Policies

While the Province of Alberta also has leased public lands since the 1930s, its land disposal program differed substantially from Saskatchewan's before the latter reversed its policies in 1965. In Alberta, alienation of public lands has always remained the ultimate goal with leasing merely a temporary solution. While the Cultivation Lease has easily been the most important intensive agricultural lease in Saskatchewan, the Homestead Lease with the right of conversion to the freehold has been the overwhelming choice in Alberta.

In 1953 Wood, now the Director of Lands in Alberta, recommended that the Province sell, rather than lease, the land wherever possible.[12] Wood pointed out that Alberta farmers, like farmers in Saskatchewan, New Zealand, Australia, and the United States, prefer to hold their land in

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[11]Polischuk (letter, 20 November 1968).

[12]V. A. Wood, "Public Land Policy for Alberta."

fee simple because more status is attached to land ownership. They associate leasing with insecure tenure, lack of compensation for improvements, and lack of freedom of operation. Wood agreed with the Saskatchewan Commission's view that leasing could often prove more beneficial to the farmer than freeholding. Yet, unlike the Saskatchewan Commission, he concluded that the vital consideration was the inability of the average farmer to grasp the advantages of leasing. He recommended farm ownership because it resulted in "a greater willingness to sacrifice time, money, and labor for development " (p. 150).

Since the 1930s, Alberta has disposed of its lands suited for intensive agriculture by sale, Homestead Lease, or by short-term Cultivation Lease. In recent years the Province has virtually abandoned leasing in favor of freeholding. Implementing Wood's recommendations, it has ceased issuing Homestead Leases although 2600 such leases are still in force. Wood envisioned Cultivation Leases as stopgap measures in the southern grazing areas where some land might be turned over to farming under modern farming techniques on an experimental basis. If found suitable for farming, the land could be sold outright. Yet, leases are still important on Alberta public lands, and as of 1967, the following were in effect:

	Number	Total acres
Homestead Leases	2,600	673,333
Cultivation Leases	830	159,634
Miscellaneous leases	1,155	74,596
Grazing Leases and Permits	6,444	4,969,459

In the same year the following sales were in process:

	Number	Total acres
Homestead sales in force	4,199	1,115,290
Agricultural farm sales	1,710	307,927
Public land sales	1,551	231,584

As these figures indicate, there is considerable demand for land in Alberta. Most of this demand is found in the Peace River Valley in the Northwest.

As in Saskatchewan, there has been agitation in Alberta for increasing the size of public land grants to form more viable economic units. In recent years the Province has increased the maximum

area granted from 320 to 800 acres, of which half must be cultivatable.[13]

Rentals are largely paid in cash rather than in crop shares. Under the Homestead Leases, however, the farmer is not required to pay rent on lands he breaks himself during the first three years. In the fourth year he pays one-eighth of the value of his crop. On lands already under cultivation he pays one-fourth of the value of his crop as rent. He may apply for title after five years by paying $100 a quarter or $300 a half section. In the next five years 20 percent of his title payment is written off provided he has fulfilled the government's requirements for improving the land. During the entire 10-year period he pays no taxes, these being calculated in the government's share of his crop. At the end of 10 years he acquires title.

Under Cultivation Leases the rent is based on the assessed value of the land. The government may forgive the lessee his rent for the first four years for breaking the land. At the end of this period, or earlier if 25 percent or more of the land is under cultivation, the rent is a minimum of 30 cents an acre. Under Cultivation Leases, the tenant is not automatically entitled to convert to fee simple ownership as are Homestead Lease tenants. However, he has first choice if the Department of Lands decides to sell the land.

Under the government's Homestead Lease policy, the purchaser may also be forgiven his rent and taxes for up to four years, after which he is required to make his payments in no more than 19 annual installments with 4.5 percent annual interest on the balance. The Department of Lands bases its rent on the assessed value of the land and the cost to the government of providing access to the land.

Agricultural farm sales are used less frequently and are generally for more developed lands. The purchaser's equity is in cash rather than in leasing and breaking, and the payment term is generally shorter. A down payment of at least 20 percent of the purchase price is required with the remainder to be paid in installments with 4.5 percent annual interest on the balance. The years allowed for payment are as follows:

10 years when the purchase price is less than $1,500;
15 years when the purchase price is from $1,500 to $3,500;
20 years when the purchase price is $3,500 or more.

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[13] Alberta Department of Lands, Annual Report, 1967, (Edmonton: L. S. Wall, 1967), pp. 25-29; Province of Alberta, An Act Respecting Public Lands, 1966 (Edmonton: Queen's Printer, 1966), p. 27; Von Eckhard Ehlers, "Landpolitik und Landpotential in den nordlichen Kanadischen Prairie provinzen, "Z Auslandische Landwirt, V (January 1966), p. 55.

Wood considered alternate methods of consummating sales and lease disposals. He preferred sealed bids to public auctions because he believed that auctions unduly inflated the value of the land and that sealed bids came closer to the market value. He suggested that where the available land was inadequate to form an economic farm unit, the government should sell the land to the local farmer who most needed it.[14] In Alberta as in Saskatchewan, there appears to be little disagreement with the government's rental rates or sale prices based on market value.

Insecurity of tenure has not been a serious problem since the government's land policy has been geared to eventual ownership. Homestead Leases are granted for a period of 20 years with a right of renewal for another 20 years, thus providing ample time to convert the leasehold to a freehold. Cultivation Leases are limited to 10 years, with the lessee having first preference if the government wishes to renew it. As noted previously, Cultivation Leases may be converted to purchase agreements if the land is found suitable for agriculture.

Wood recommended in 1953 that the lessee no longer be allowed to assign his lease. Such assignments were often quite profitable because the government's rental rates were generally below the open market rental rates. Provided that he received equitable compensation for improvements, Wood saw no reason why a lessee should make a profit at the expense of the government. While his recommendation was not implemented, the shift away from leasing since 1953 has helped to resolve the problem. On homestead sales the Province does not permit the purchaser to transfer the land unless he has performed the cultivation duties prescribed by the government for at least four years.[15]

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[14] Spence, Modern Land Policy, p. 377; Government of the Province of Alberta, The Public Lands Act, 1966, Cultivation Lease and Permit Regulations (Edmonton: Queen's Printer, 1966), pp. 1-3; Government of the Province of Alberta, The Public Lands Act, 1966, Homestead Sale (Edmonton: Queen's Printer, 1966), pp. 9, 11-14; Government of the Province of Alberta, The Public Lands Act, 1966, Agricultural Farm Sales Regulations (Edmonton: Queen's Printer, 1966), p. 3; Wood, "Public Land Policy for Alberta," pp. 164-66.

[15] V. A. Wood, "Alberta's Land Policy, Past and Present," Journal of Farm Economics 33 (November 1951), p. 741; Alberta Department of Lands, Annual Report, 1967; Wood, "Public Land Policy for Alberta," pp. 160-61; Province of Alberta, An Act Respecting Public Lands, p. 36.

Compensation for improvements has not been an important problem of Alberta's public land policy. The lessee has long been entitled to compensation for permanent improvements. Wood recommended compensation also for an increase in soil fertility and for unjustified disturbance. Although the government still does not compensate for an increase in soil fertility, it does give more consideration to paying compensation for cultivation, clearing, summer fallowing, etc. at the expiration of a lease. Recent legislation has clarified the lessee's rights when rights of way, pipelines, etc. disturb his quiet enjoyment of his lease.[16]

As in Saskatchewan, Alberta farmers have not complained as much about rental rates, insecurity of tenure, or compensation for improvements and freedom of operations as about insufficient capital for improvements. In contrast to Saskatchewan, which extends cash grants per acre to the lessee for putting land into cultivation, Alberta provided no capital to its settlers until recently. However, rents may be forgiven for the first three crop years of the lease. Mortgage payments do not start until the fourth year when fewer than 25 acres are cultivated, the third year when 25-50 acres are cultivated, and the second year when more than 50 acres are cultivated. For every quarter section held, the Homestead Lease farmer is obliged to break and seed to crop a minimum acreage as follows:

Year	Acres to break	Acres to seed
First	10	0
Second	10	10
Third	10	20
Fourth	10	30
Fifth	0	40
Sixth	0	40
Seventh	10	40
Eighth	10	50
Ninth	0	60
Tenth	0	60

Cultivation Lease requirements are similar. Since most of the public lands leased or sold require extensive improvements, the government's land utilization requirements, along with the absence of capital, have posed severe problems which the government has not yet satisfactorily solved. One suggestion for solving this problem is for the government

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[16] Wood, "Public Land Policy for Alberta," p. 160; V. A. Wood, Director of Lands, Province of Alberta (letter, 21 November 1968).

to develop the land before selling it to farmers. Another is that the land should be sold to large private investors who would develop the land and resell to farmers. Both of these methods have been used in Australia.

Wood recommended in 1953 that the Province guarantee loans for improvements made through regular agencies like the Provincial Treasury Board or the Dominion Government Farm Loan Board. To protect itself the government would restrict the larger share of the loan to capital improvements on the land itself. Wood felt that the lessee should be required to invest some of his own money since this gives him more pride in his farm and work. In the past decade, Alberta has begun to extend financial assistance to new settlers through loans with a lenient repayment plan at 4.5 percent interest. Two alternative methods of government assistance suggested by Wood were a direct subsidy, as in Saskatchewan, or government-created, permanent improvements to be rented or sold on easy terms to the lessee. Wood shied away from the latter because it smacks of government paternalism. While he argued that the settler needed capital assistance, Wood believed that too much government help would stifle initiative.[17]

One of Wood's ideas that has been partially adopted was that residence rules should be eased. These rules required the settler to establish residence the first year and to live there for six months of each year thereafter. Wood argued that since most lessees must work away from the farm to obtain sufficient capital for the initial improvements, no residence should be required the first two years and only three months in the third year. The 1966 Public Land Law merely requires three months residence a year for a homesteader who is purchasing his land.[18]

Wood and others have recognized that the government must provide not only land improvement assistance but also more roads and social services to enhance the attractiveness of life in frontier regions.[19]

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[17] Province of Alberta, An Act Respecting Public Lands, 1966, pp. 24, 29, 30; Wood, "Public Land Policy for Alberta," p. 160; Wood (letter, 21 November 1968).

[18] Wood, "Public Land Policy for Alberta," p. 189.

[19] T. W. Manning, Chairman, Department of Agricultural Economics, University of Alberta (letter, 15 August 1968); Wood, "Public Land Policy for Alberta," p. 163.

The Province has never seriously interfered with the farmer's freedom of operation, except in the most extreme cases of abuse. Although the various public land acts demand good farming practices, enforcement is the responsibility of overworked district agriculturalists under the Department of Agriculture, who have been unable to give sufficient attention to it apart from other duties. Wood believed that when necessary, the government should use its police powers to prevent freeholders from causing soil deterioration. He noted that the Provincial government had little statutory authority over landowners and hoped for the enactment of more legislation like the Noxious Weeds Act. He also hoped that the government would specify in its leases the use to be made of the land. Wood conceded, however, that the popular belief in the sanctity of private property probably precluded the acceptance of his recommendations. He suggested that the same end might be achieved by providing farmers with more technical advice and by taxing land on the basis of its productivity. Although Wood's suggestions have not been implemented, the Province has attacked the problem from another angle by screening applicants for public lands. In some areas in recent years it has established boards composed of representatives of the Department of Lands and prominent farmers, to review and make recommendations on applications for public lands.[20]

To conclude--Alberta's land disposal policies for intensive agriculture are probably the most pertinent to the situation in the United States. Although the Province has leased its public lands, its basic goal has been fee simple ownership.

Grazing Leases

Although grazing leases are not the primary purpose of this study, a note on the leasing policy for grazing lands in Alberta and Saskatchewan may be of interest. In neither Province has there ever been any real controversy over public ownership. While Canadians strongly approve private ownership of farms, they agree on public ownership of range land.

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[20] Province of Alberta, An Act Respecting Public Lands, 1966, pp. 15-16; Wood, "Public Land Policy for Alberta," pp. 72, 146, 153; Wood, "Alberta's Land Policy," Journal of Farm Economics, pp. 747-48; Wood (letter, 21 November 1968).

In Alberta, rental rates have been the main source of contention over the years. In the 1930s and early 1940s the rent was based on a flat rate per acre. Ranchers objected to this system because of the low cattle and sheep prices and the droughts of the thirties. In 1945 the government adopted a flexible cash rent that was proposed by Alberta stockgrowers. Under the new method the rent per acre is "one-tenth of the annual rate of gain of cattle on grass in pounds of beef per head, multiplied by the weighted average price of all classes of cattle . . . on the Calgary market . . . in the preceding year, divided by the number of acres required to carry a mature head of cattle on the range for twelve months."[21] Ironically, the plan raised rents rather than lowering them because it was introduced during the postwar era of rising prices. Saskatchewan has since adopted this plan.

Ranchers have been encouraged to practice sound conservation principles. They may not carry as many cattle under the new as they did under the old rate schedule, but the cattle and the range are maintained in better condition. Despite the higher rentals the ranchers are generally satisfied.

Lands are generally leased for grazing for a term of 20 years in Alberta and 21 years in Saskatchewan. The lease is renewable and assignable by the lessee. He is entitled to compensation for improvements, although here again the real difficulty is a lack of capital. Wood wanted the government to provide limited financial assistance to encourage range development and improvements such as reseeding, developing water supplies, and eradicating bush and poisonous weeds. He also favored range management plans worked out by ranchers and government experts.[22]

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[21] V. A. Wood and J. A. Campbell, "A Range Land Rental System Based on Grazing Capacity and the Price of Beef," Journal of Range Management 4 (November 1951), pp. 370-4.

[22] Wood, "Public Land Policy for Alberta," p. 171; Province of Alberta, An Act Respecting Public Lands, 1966, pp. 15-16.

II. AUSTRALIAN LAND POLICIES

Intensive Agriculture

A discussion of Australian public land policy is complicated because it includes the policies of the six separate States that hold most of the public lands. The Commonwealth government is directly responsible only for the Northern Territory and therefore, a wide variety of land policies and legislation exists. Nevertheless, some general characteristics of Australian land policy are discernible. There is much more public than private land, and most of the public lands are used for grazing under a lease. The tenure status of Australian lands is shown in the following table:

Private and public ownership of lands in Australia, by States and Territory, 1964

Government	Total acres (millions)	Private lands		Public lands	
		Alienated	In process	Leased	Other
		percent			
New South Wales	198	30	4	57	9
Victoria	56	57	4	11	28
Queensland	427	6	1	87	6
South Australia	243	7	(*)	60	33
Western Australia	625	5	2	40	53
Northern Territory	333	(*)	(*)	58	42
Tasmania	17	39	1	9	51
Australia	1900	9	2	56	33

Source: Australian Bureau of Census, Yearbook, no. 52 (1966), as presented by Campbell, Agriculture in the Australian Economy, p. 172.

*Less than 1.0 percent.

As in the United States and Canada, Australia has generally freeholded its land for intensive agriculture, although some States have preferred to lease in order to resume land for closer settlement. The State of Queensland and the Commonwealth in the Northern Territory have preferred leasing. But in recent years, even these areas have turned to freeholding.

Special Commonwealth investigating commissions have recommended the freehold over the leasehold. In 1944, the Rural Reconstruction Commission, which studied the prospects for Australian agriculture after World War II, reported that "land ownership implies a freedom from interference, a continuity of existence on one property," and noted the social prestige that land ownership conferred. In 1959 the Commission to Inquire into the Prospects for Agriculture in the Northern Territory recommended that the Commonwealth permit freeholds there. It declared that even a perpetual lease did not provide secure tenure since some of the land could be resumed for closer settlement.

The perpetual lease has been recently defended by Campbell who pointed out that it requires no initial capital investment and that it provides secure tenure which eases the obtaining of production loans and encourages improvement and good farming practices. Like Wood in Alberta, he argued that the perpetual lease is often superior to the freehold. But in Australia, as in Alberta, the popularity of the freehold seems too strong to resist.[23]

At present, the major issue in Australian land policy is the concept of the "home maintenance area" which has been written into land legislation of every State. The home maintenance area is generally defined as, "an area which when used for the purpose for which it is reasonably fitted would be sufficient for the maintenance in average

[23] Keith Campbell, "Land Policy," Agriculture in the Australian Economy, ed. D. B. Williams (Sydney: Sydney University Press, 1967), p. 172; A. C. Lloyd, "The Economic Size of Farms," Journal of the Australian Institute of Agricultural Science 27 (September 1961), p. 140; Commonwealth of Australia, Department of Territories, Committee to Inquire into the Prospects of Agriculture in the Northern Territory, Prospects of Agriculture in the Northern Territory (Canberra: Queen's Printer, 1959), p. 156. Hereafter cited as "Committee on the Northern Territory"; Keith Campbell, "Current Issues in Australian Agriculture," delivered as the G. L. Wood Memorial Lecture at the University of Melbourne on 26 August 1966.

seasons and circumstances of the average family." This concept dates from the turn of the century and has been used to encourage the family farm under both freeholding and leasing.

Since World War II the interpretation of the home maintenance area concept has been sharply criticized by economists. As Australia has become even more conscious of agriculture as the basis of its economy, it has tended to emphasize economic factors at the expense of social considerations. Critics of the home maintenance area concept stress that modern technology has expanded the area that may be farmed adequately. They also argue that a static formula based on an "average year" founders on wide fluctuations in annual rainfall or farm prices. While few want the home maintenance area abolished, most urge its revision so that it will work to expand, rather than to contract, farm size.[24]

On Australian lands, complaints about rents have not been a significant problem. Political pressure, as in Canada and the United States, tends to cause land to be undervalued for assessment. A typical rental rate is 2.5 percent of the assessed value of the land. Lessees often sell their leases before their terms expire and often realize handsome profits because purchasers are willing to pay for the difference between the government's low rental rate and the rental value of the land in the market place.

Current criticism of rental policy does not come from settlers but from economists anxious that the government earn a fair return from its property. Campbell believes that the lessee should not profit from the government's low rent when selling his lease, and MacPhillamey wants more frequent valuations so that rents will keep pace with rising values.[25]

There has been some objection that any lease short of a perpetual lease or purchase lease does not provide secure tenure. Queensland and the Northern Territory have traditionally limited their leases

[24] Campbell, Agriculture in the Australian Economy, p. 174; Samuel Wadham, Australian Farming, 1788-1965 (Melbourne: F. W. Cheshire, 1967), p. 46; J. N. Lewis, "Is the Concept of the Home Maintenance Area Outmoded?" Australian Journal of Agricultural Economics 7 (December 1963), p. 104.

[25] Campbell, Agriculture in the Australian Economy, p. 175; Committee on the Northern Territory, p. 156; C. H. MacPhillamey, "Factors Affecting Rural Land Prices in N.S.W. and the Construction of Indexes of Rural Land Values," Australian Journal of Agricultural Economics 8 (December 1964), p. 153.

to 25 to 40-year periods in order to regain land for closer settlement. Campbell and Gruen argue that this policy is anachronistic since the shorter term provides relatively little incentive for capital investment in an age when such investment has become especially important.

In recent years Australia has endeavored to provide more security of tenure. In 1952 Queensland alleviated some of the lessee's uncertainty by allowing him, if his term had more than seven years to run, to retain a home maintenance area when the lease is terminated for subdivision into smaller units for closer settlement.

New South Wales in 1966 relinquished its right to repossess land for closer settlement on a large number of estates. And the Northern Territory has allowed its leases to be renewed for a full term before repossessing the land. Presently, most Australian leases for intensive agriculture are perpetual with provision for freeholding after the pattern set by the Commonwealth in the War Service Settlement Scheme in the 1940s.[26]

Freedom to improve is currently not a problem since in most Australian States the lessee receives compensation for permanent improvements. Instead, lack of sufficient capital for improvements is the prevailing source of discontent. By 1967 standards it is estimated that £40,000 are needed to buy a grain farm and equip it with machinery and livestock. Critics have generally recommended adjustments, but no major changes have been made by present credit agencies, which include trading banks and pastoral finance companies.

To permit farmers to adopt scientific technology, more credit is needed. But the Committee to Inquire into the Prospects of Agriculture in the Northern Territory recommended that the government should avoid as much as possible the extension of direct credit to the farmer. It should also be noted that one reason the States have turned to the freehold lies in the inability of leaseholders to obtain capital because they cannot offer freeholds as security.

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[26]Campbell, "Current Issues in Australian Agriculture," p. 7; F. H. Gruen, "Capital Formation in Australian Agriculture," Australian Journal of Agricultural Economics I (February 1957), p. 102; T. H. Strong, "Land Tenure in Australia in Relation to Technical Advances and Closer Settlement," Journal of Farm Economics 38 (May 1956), p. 463; Campbell, Agriculture in the Australian Economy, p. 177; Committee on the Northern Territory, p. 154.

The State governments, however, compound the capital problem by requiring lessees to develop their land rapidly. Western Australia, for example, requires the holder of a conditional purchase lease to clear and pasture 1000 acres of a 2500-acre farm in a five-year period. Moncrieff showed that only farmers with an initial capital of $25,000 could comply with this requirement and still achieve the maximum return. Below the $25,000 level they would have to use less seed and fertilizer with a corresponding reduction in net profit.[27]

Since World War II Australia has experimented with three possible solutions to the farmer's capital conundrums: (1) the War Service Land Settlement Scheme, (2) State government development projects, and (3) private development by land investment companies. Under the first approach, the States improved the land, often erecting structural improvements. Even after the basic developmental phase, the States granted the settler a living allowance until the land was brought up to standard. Although the value of the improvements was added to the settler's rent or purchase price, the government never recovered its full investment in land or development. The program was regarded as successful, but it is doubtful that it could be revived today because it rested on the non-economic objective of rewarding veterans, while today's objectives are more strictly economic.

Although the veterans' demand for land has abated, some State governments have continued development programs now open to all settlers. The Commonwealth government has continued to provide financial assistance. There are several current governmental projects for intensive agriculture. One is the Brigalow Land Development Scheme in Queensland in which farms are being made available for cereal and wheat production and stockgrowing. Another is the Coleambally Irrigation Area project in New South Wales where 1000 new farms are being planned to produce fruit and vegetables along with cereals and wheat. There are also two projects in Western Australia--one in the Oral River valley where the feasibility of irrigated crops of cotton, sorghum and safflower is being investigated and one in the Esperance area in the Southwest which is devoted to stock raising and cereal growing. Because the world market price for beef is much more favorable than for wheat and cereal crops, Australia hesitates to undertake additional projects. The land is made available in a variety of leases and purchase agreements, but all the

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[27]I. J. Moncrieff, "The Land Act and Farm Development," Farm Policy 3 (September 1963), p. 47; I. J. Moncrieff and R. G. Mauldon, "The Effect of Land Clearing Regulations on the Rate of Farm Development--A Case Study," Australian Journal of Agricultural Economics 7 (December 1963), p. 176.

lands devoted to intensive agriculture can eventually be freeholded. Unlike the Commonwealth's War Service Land Settlement Scheme, the State governments do not give special subsidies. Rather these State plans tend to impose minimum capital requirements.

In addition to public land development, Australia has also experimented with private programs, which so far have not proved very successful. This approach still suffers from the failure of the Esperance Scheme in Western Australia in the 1950's. There the State gave a syndicate of Australian and American investors an option on 1,500,000 acres at 45 cents an acre. The syndicate was to develop the land and sell to settlers at a price allowing for a fair return on the investment. The program collapsed, however, because in its haste for quick profits, the company developed the land too rapidly. In 1959 the State withdrew the syndicate's option and began to dispose of the land itself.

In 1960 Western Australia signed a contract with another private group which agreed to spend $4,600,000 to develop 1,500,000 acres by 1974. As of 1967, the plan was working successfully. Campbell hopes that better use can be made of private development companies because capital is short at present, and these companies provide access to American investors.[28]

Farmers have a high degree of freedom of operation in Australia. The government does not strictly enforce its right to exact sound farm practices from its lessees, although it does demand removal of vermin and noxious weeds. And here, as in Canada and New Zealand, experts such as Campbell want the government to supervise more closely freeholders as well as leaseholders, but because farmers have more votes than agricultural economists, it is doubtful if these recommendations will have any more effect than similar suggestions by Wood in Alberta.[29]

In conclusion--it appears that in the future, credit facilities for farmers will continue to be less than ideal, and that while the States will continue to develop land, private companies will become more important. Farmers who have, or can obtain, capital needed for development

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[28] T. P. Field, Post-War Land Settlement in Western Australia (Lexington, Kentucky: University of Kentucky Press, 1963), pp. 11, 12, 43; S. F. Harris, Director, Bureau of Agricultural Economics, Commonwealth of Australia (letter, 21 August 1968); Campbell, Agriculture in the Australian Economy, p. 181; Campbell, "Current Issues in Australian Land Policy," p. 7.

[29] Campbell, Agriculture in the Australian Economy, p. 183; Committee on the Northern Territory, p. 155.

will be most likely to secure land. Also, because present limits on farm size prevent a desirable income level for the farm family, it seems safe to predict that size limitations will be revised upward.

Individual States

Because there is some variation in land policy among the various States, it seems best to discuss a representative group, including Queensland, the Northern Territory, Western Australia, and New South Wales.

Queensland

Queensland, alone among the Australian States, has a tradition of favoring the leasehold over the freehold and resuming land for closer settlement. Of its 427 million acres only 6 percent are alienated, and 87 percent are leased. Except for a three-year period, the State sold no Crown land between 1916 and 1957. It disposed of lands for intensive agriculture by perpetual lease. In 1957, however, in order to attract more investment, it began to sell land again and permitted the conversion of perpetual leases to the freehold. It has continued to liberalize its laws, even permitting the conversion of grazing leases.

At present there are three major methods of obtaining land for intensive agriculture in Queensland. The two most prevalent are freeholding and perpetual lease. Under both tenures a settler may acquire usually no more than 2500 acres although he can obtain up to 5000 acres if he is willing to spend at least 10 dollars an acre on land improvement. The selling price of public land, whether purchased outright or secured by conversion of a perpetual lease, is based on the unimproved value of the land. The price set is to be paid in annual installments without interest. Both freehold and perpetual lease tenures have residence requirements. Rents for perpetual leases are 2.5 percent of the capital value of the land, and the rents are reviewed every 10 years.

A third tenure is the Settlement Farm Lease, which is designed for semi-arable lands used for mixed farming and grazing. It obligates the lessee to cultivate a specified area within a specified time. Its term is 30 years with the rental reviewed every 10 years. The lessee must observe residence requirements and may convert the lease to a freehold.

At present the most favored agricultural areas have been freeholded. Very little land remains for intensive agriculture because Queensland prefers to develop potentially arable land for stockgrowing in view of the current world market prices. In general, there seems

to be little dissatisfaction with Queensland's land policy, although there has been some criticism of the government's policy regarding compensation for improvements. While the government pays for structural improvements, it does not compensate the lessee for the clearing costs which in more primitive areas are quite high. Critics have charged that this lack of compensation retards development.[30]

The Northern Territory

The Northern Territory is the most arid region of Australia and grants very little land for intensive agriculture. Less than 1 percent of its 333 million acres is alienated or private land. Virtually all of its occupied land is held on lease. Of these 140,000,000 leasehold acres, only 143,000 are held on agricultural leases, and much of this land is held under a mixed farming-grazing lease. Agricultural leases are perpetual with a review of the rental every 10 years, although there is a ceiling beyond which the rent may not be raised. The lessee is obliged to fulfill a residence requirement.

The Commonwealth has tried to stimulate the development of the Northern Territory's unpromising land for intensive agriculture. It remits the lessee's rent for the first 21 years or his lifetime, whichever is shorter. In 1956 it introduced the Agricultural Development Lease which appeals to private development companies. The developer's term may not exceed 30 years, and he must subdivide all or part of his land for agricultural leases. He is, however, entitled to compensation for improvements. The Committee to Inquire into the Prospects for the Development of Agriculture in the Northern Territory recommended shifting from the perpetual lease to freeholding in order to attract new capital for agricultural development and to provide security for settlers seeking loans. The Commonwealth now permits land to be freeholded, subject to restrictions, some of which are uncommonly

[30] Commonwealth Bureau of Census and Statistics, Queensland Office, Queensland Yearbook, 1966 (Brisbane: Queen's Printer, 1966), p. 139; V. B. Sullivan, Digest of the Land Laws of Queensland (Brisbane: Queen's Printer, 1968), pp. 1-13; W. A. T. Summerville, "Settling Brigalow Lands," Queensland Agricultural Journal 88 (December 1962), p. 705; W. Bott, "Plough Moves into the Goondivindi District," Queensland Agricultural Journal 89 (May 1963), p. 292; Secretary of Land Administration Commission, Department of Lands, Queensland (letter, 23 August 1968); Wadham, Australian Farming, p. 76.

rigid. It forbids selling land to an incorporated company and limits the maximum area one person may hold to 20,480 acres. It also does not permit the new owner to transfer or sometimes even to mortgage his land without official consent, and it limits the purchase period to no more than 20 years.

Freedom of operation is the rule in the Northern Territory, although the Committee recommended that the government make more use of its power to enforce good farming practice.[31]

Western Australia

Western Australia has a strong freehold tradition. Under its 1893 Homestead Act, it granted 160 acres free to settlers. The provision remains in the current Land Act, passed originally in 1933, although it is a dead letter since the best land has long since been taken. The major lease for intensive agriculture is the Conditional Purchase Lease. Purchase payments are spread over 25 to 30 years and extensions are permitted. A Conditional Purchase Lease is limited to 5000 acres. The State ordinarily requires the lessee to develop half of the land within 11 years.

In Western Australia, as elsewhere, the trend since World War II has been toward making ownership easier. In 1951 the State allowed war veterans, who were holding perpetual leases under the War Service Land Settlement Scheme, to purchase in fee simple after 10 years. In 1960 it amended this to permit freeholding in less than 10 years.[32]

New South Wales

In its early years New South Wales' land policy oscillated between the perpetual lease and the freehold. The freehold system is currently dominant although the State grants farm lands on perpetual leases with the right to convert to the freehold. The land legislation is complicated by the fact that the State does not administer all of its lands.

[31] Committee on the Northern Territory, pp. 151-7; Commonwealth Department of the Interior, "Land for Settlement in the Northern Territory," unpublished manuscript (February 1968), pp. 1, 7.

[32] T. P. Field, Post-War Land Settlement, pp. 10-11, 55-58; Commonwealth Bureau of Census and Statistics, Western Australia Office, Western Australia Yearbook, 1967 (Perth: Queen's Printer, 1967) pp. 235-238, 242-244.

The grazing lands in the western part of the State are administered by the Western Lands Commission and those in irrigation areas by the Water Conservation and Irrigation Commission.

Public land leases in New South Wales are held under the Agricultural Holdings Act of 1941 which governs both private and public leases. The Act was based on England's Agricultural Holdings Act of 1923 and is, by far, Australia's most ambitious attempt to protect the tenant. While earlier laws granted the tenant fixity of tenure, freedom to improve, and freedom to operate, they also allowed him to renounce those rights. Many landlords required the tenant to relinquish these rights, especially compensation for improvements. The 1941 Act forbids the tenant to contract away these rights. The New South Wales Agriculture Holdings Act also protects the tenant's right to compensation for such items as hay and straw stored on the farm at the end of the lease, to any increased value of the holding resulting from a higher standard of farming than required, and for disturbance of tenure. If the landlord effects improvements himself, he may not charge the tenant an annual rent of more than 5 percent of his cost. The law also protects the landlord from the cost of unnecessary improvements made by the tenant. The tenant may practice any form of cropping he desires and cannot waive this right. However, the landlord is entitled to compensation if the tenant injures his land.[33]

Campbell notes that, despite its scope, the Act has fallen somewhat short of expectations:

> The chief defect . . . is that both the provisions covering payment of compensation to tenants and those requiring adequate notice to quit have generally proved ineffective in the case of verbal agreements. This is because the Act conflicts with the seventeenth century English Statute of Frauds which applies equally in Australian law and which provides that any agreement not performed within one year must be in writing if it is to be enforceable. Unfortunately, verbal agreements are rather prevalent, and landlords themselves are disposed to avoid written contracts under present circumstances. There is also mounting agitation by landlords for amendment of the Act on the ground that the legislation as it now stands makes it excessively difficult to dismiss inefficient and incompetent tenants and share farmers.[34]

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[33] A. W. S. Moodie, "Farm Tenancy in New South Wales--The Agricultural Holdings Act, 1941, and its Application," Agricultural Gazette of New South Wales 54 (1943), pp. 206, 209, 261, 264, 266, 308.

[34] Campbell, Agriculture in the Australian Economy, pp. 176-7.

Grazing Leases

While Australians prefer freeholds for intensive agriculture, they prefer leaseholds for grazing lands. The Committee to Inquire into the Prospects for Agriculture in the Northern Territory expressed the prevailing view when it recommended retaining the leasehold on pastoral land for the immediate future to prevent overgrazing and other malpractices and to protect the State from selling land at very low prices.

A variety of tenures is used for disposing of Crown lands for grazing as illustrated by the land law of Queensland. The State employs the Pastoral Lease in the remote areas where more than 45,000 acres are needed for a living area. The term is generally no longer than 30 years with rent adjustments at 10-year intervals. The State also grants a Pastoral Development Lease where costly improvements are needed to improve carrying capacity and productivity. The Pastoral Lease and Pastoral Development Lease are the only two without limitations on the amount of land that can be held without prohibitions against corporation farming and without residence requirements. They are, however, the only two leases in which the State retains the right to resume a portion of the land before expiration, a right that may be exercised over as much as one-third of the land after 15 years.

Two other popular holdings are the Preferential Pastoral Holding Lease and the Grazing Homestead Lease. Both are designed for more closely settled areas. The Preferential Pastoral Holding Lease is generally granted for land on the fringe of closely settled areas or for poorer quality Crown Land within these areas. The maximum area that may be held under this tenure is ordinarily 60,000 acres. The Grazing Homestead Lease is limited to a maximum of 45,000 acres although this ceiling can be raised to 60,000 acres. Both leases exclude corporations and impose residence requirements. Grazing leases also often require that livestock be limited to reasonable carrying capacity. However, both leases provide considerable security of tenure in that the government may not resume land before expiration of the lease term.

In all of its leases Queensland has made an effort to mitigate the tenant's uncertainty near the end of his tenure. It permits him to surrender his land at any time within the last 10 years of his term for a new lease. Although the lessee often must relinquish some land for closer settlement in the new lease, he has the advantage of a more secure tenure in the remaining area.

Queensland's leasing policy for grazing lands is typical of that of the other Australian States. In the even more sparsely developed States of South and Western Australia, however, grazing leases run for still longer periods--up to 99 years. The ranches are much larger--a ranch of 75,000 acres is considered a small grazing unit. Some stations may include as much as 420,000 acres. Annual rentals average $2.25 per square mile. Australian graziers seem well satisfied with their conditions. An American visitor in 1958 observed that most of the operators were well educated and efficient. As a result, they enjoyed a high standard of living despite their remote locations. He concluded that these lessees enjoyed "an unusual security of tenure." In the light of the waning enthusiasm for closer settlement and smaller living areas, it appears that Australian ranchers will become even more secure in the foreseeable future.[35]

[35] Sullivan, pp. 1-13; Royale K. Pierson, "Public Land Grazing Down Under," Our Public Lands 7 (April 1958), pp. 4-5, 12-14.

III. NEW ZEALAND LAND POLICIES

Much of New Zealand's public land policies are not relevant to intensive agriculture since its agricultural economy is based primarily on cattle and sheep grazing. As of 1963, it devoted only 406,000 acres to cereal production and 813,000 acres to grain, root, and other crops.

Of New Zealand's 40 million acres of occupied land, 22 million acres are privately held while 18 million acres, or 45 percent, are public lands belonging to the Crown. Of the 18 million acres, 2.6 million acres are held under 5,000 Renewable Farm Leases and 0.5 million acres under 1400 deferred payment farm licenses. The Renewable Farm Lease is used to dispose of cropland and can be converted to a freehold. Cropland is also sold for cash or deferred payments. The typical farm lease runs for 33 years and may be renewed. The basic land law, the Land Act of 1948, specified that rentals shall be 4.5 percent and deferred freehold payments 4.62 percent per year. However, in 1956 both rates were eliminated, and charges are left to the discretion of the Land Settlement Board.

The history of New Zealand's public land policies is similar to that of other nineteenth century frontier regions such as Canada, Australia, and the United States in that it originally stressed selling the land to encourage private settlement. In 1894, however, with the Liberal-Labor Party in power, the government became more discriminating in its land grants and also began to resume land from the large private estates for closer settlement, a policy which is still continued. The Liberal-Labor government also favored the perpetual lease over freeholding. But the fee simple tradition was so strong that the government granted no more perpetual leases after 1907. However, some 6000 granted before 1907 still exist today. The pressure of the small farmers continued, and in 1912 the Reform Party returned to power to extend the right to freehold Crown leases. Since 1912 the trend toward freeholding has continued uninterrupted to the present time and meets with general approval.[36]

[36] Horace Belshaw, "Land Tenure and the Problem of Tenurial Reform in New Zealand," Family Farm Policy, ed. Joseph Ackerman and Marshall Harris (Chicago: University of Chicago Press, 1947), pp. 175-80; New Zealand Department of Statistics, New Zealand Official Yearbook (Wellington: Government Printer, 1964), pp. 286, 288; R. J. MacLachlan, "Land Administration in New Zealand," address read before the 1967 Conference of the New Zealand Institute of Valuers, pp. 9-11.

During the 1960s farmers charged the government with placing excessive valuations on its land, to which the government responded by appointing a special investigating committee that reported in 1968.[37] The Committee recommended several changes for Crown lands. Noting that the 33-year lease in a period of rising land values unfairly discriminated against the Crown, it suggested that charges be reviewed every 11 years. To soften the effect of this change, it suggested that the Crown charge 0.5 percent less than the prevailing interest rate.

The 1968 Committee recommended that perpetual leases be converted into freeholds although it did not specify how this should be done. The Committee also recommended instituting a purchase lease, already in use in some Australian States. This purchase lease requires no deposit but calls for an annual fee which includes the purchase price and rent. The Committee hoped that this lease, which is similar to a long-term mortgage, would meet the needs of settlers for greater security of tenure.[38]

The 1968 Committee also suggested changes in the government's fees for converting a lease into a freehold. At present the government does not credit a lessee with the market value of his low rental lease. This low rental during a period of rising land values constitutes an asset which the lessee can realize by selling the lease. Although earlier land laws recognized this as the lessee's asset when calculating the freeholding charge, current legislation does not. The 1968 Committee recommended the amending of the Land Act of 1948 to allow the lessee to deduct this asset from the purchase price if he should convert to the freehold.

As noted earlier, the 1968 Committee recommended that perpetual leases be discontinued. Since these leases--actually 99-year leases--are relics of the 1894-1907 era when land values were much lower than today, the rents charged are extremely low. Yet the Committee offered no advice on how to induce these lessees to freehold, and it is doubtful that they will voluntarily give up their comfortable situation without substantial inducement.

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[37] Report of the Committee of Investigation into Rentals and Freeholdings of Crown Leases (Wellington: Government Printer, 1968), p. 14. Hereafter cited as "1968 Committee."

[38] MacLachlan, p. 12; New Zealand Department of Statistics, pp. 286, 288; 1968 Committee, pp. 16, 18.

It should also be noted that, unlike the Canadian Province of Saskatchewan, New Zealand makes no provision for reducing rents in the event of a crop failure or low prices, However, New Zealand's climate is stable enough so that crop fluctuations are not a serious problem.[39]

Aside from fair rents there has not been much of a problem on the public lands of New Zealand. Fixity of tenure is generally guaranteed by the standard 33-year lease with the right to renew for another 33 years. In some cases, generally for conservation reasons, the government reserves the right of renewal and limits the lease's length.

The Crown also permits the lessee the right to convert to the freehold and the right to sell the lease. On this latter point, the Committee ruefully noted that the great demand for land caused many settlers to lease land at rental rates equal to those being paid for freeholds and also to accept the added risk of increased rates at renewal time.[40]

Compensation for improvements is standard in Crown leases. The lessee may purchase Crown improvements at any time (with the approval of the Land Settlement Board) in cash or on a deferred payments basis. The lessee is responsible for maintaining the government's improvements and must insure Crown property.

The 1968 Committee did find some confusion and discontent among lessees with government owned improvements. Although these improvements are not always mentioned or clearly defined in the lease, their value is included in the rent. Under the 1948 Land Act the lessor is entitled to the current value of his unexhausted improvements. The government, therefore, has a problem in determining its unexhausted improvements and in valuing them at current prices. Moreover, if the lease changes hands, there is often considerable confusion over the ownership of various improvements and also disagreement over the amount of compensation to be paid. The 1968 Committee sided with the lessee and recommended that the government sell the improvements at their value to the lessee rather than at their current value. It argued that although the Crown would lose the increased value, it would at least save the time and money spent trying to prove the value of improvements.[41]

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[39] 1968 Committee, pp. 15-16; Belshaw, Family Farm Policy, p. 201.

[40] New Zealand Department of Statistics, p. 298; 1968 Committee, p. 20.

[41] 1968 Committee, pp. 17-18.

Historically, capital has been less of a problem for New Zealand farmers on public land than for farmers in the Canadian Prairie Provinces. The government's rural loan program dates back to 1894 and has been improved steadily over the years. A milestone in its development was the Marginal Lands Act of 1950 under which the government provides advice and loans to farmers needing capital to develop marginal lands but who lack sufficient security to borrow from normal lending institutions.

The government itself has long maintained a program to develop marginal lands. In the 1941-1966 period it developed 1.8 million acres on which it settled 4,160 individuals, 3,500 of whom were ex-servicemen. Of this land 30 percent was owned by the Crown, 60 percent was private land acquired voluntarily for closer settlement and 10 percent was private land acquired under compulsion. The impetus for public land development came from the veterans settlement program which virtually ceased in the early sixties. But the government believed that economic benefits justified continuing the program, and the Crown is proceeding to develop another one million acres for at least 1,500 settlers.

Since the government makes many improvements on the land, it keeps control until it recovers the costs. It not only constructs houses and other farm buildings, but it also seeds and fertilizes grasslands. The government retains the land until the grazing capacity is firmly established, and meanwhile it markets the produce. In the mid-sixties the Crown's revenue from its land development program in a typical year was $6.2 million of which $4.8 million was derived from the sale of farm products, and only $1.4 million from time payments on land and improvements. The government relinquishes the land only when it is convinced that the incoming farmer can make a living from the start. The units granted vary from 500 to 800 acres. Virtually all of this new land is devoted to grazing.[42]

A popular method for settling ex-servicemen after World War II was to employ them for wages on land being developed and to allot them a section of this land when the development was completed. When the emphasis shifted to settling civilians in the 1960s, the government stressed financing the settler over and above his deposit of 10 percent of the total value of the land, improvements, and stock.

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[42] C.A. McIlroy, "How the State's Land Development Program Meets the Challenge of Change," Service (New Plymouth, Summer 1966), pp. 4-9.

The Crown's land development program is popular. A recent criticism has had nothing to say about improvements or capital availability but has come from South Islanders who feel that the government has slighted them in favor of developing North Island.[43]

As in the other areas studied, the New Zealand government does not interfere significantly with the lessees' operations but has tried to avoid this problem largely by screening out undesirable applicants. The 1968 Committee recommended that the government reject applicants who are so heavily indebted that they might not follow sound conservation practices.[44]

In sum, New Zealand has disposed of public land for intensive agriculture for the past 60 years through the freehold, with leasing a temporary expedient. Generally, the government's leasing policy has been satisfactory. The main complaint has recently come from farmers disturbed at the high evaluations of public lands, and this complaint appears to be near a solution.

As for grazing lands, New Zealand--like Saskatchewan, Alberta, Australia, and the United States--prefers to lease them. There are two basic leases, the Pastoral Lease for 33 years with a right of the renewal and a Pastoral Occupation License which runs for a term of up to 21 years and carries neither a claim to the land itself nor the right of renewal. Rentals for pastoral leases varied from $1-3 a square mile at 1958 prices, but the lessee is ordinarily required to make annual improvements such as fencing, water development, and tree planting. The pastoral lessee is entitled to compensation for permanent improvements, but the holder of a Pastoral Occupation License has no such claim unless the Land Settlement Board grants an exception or unless the license is renewed. As of 1963 there were 448 Pastoral Leases covering 6.8 million acres and 54 Pastoral Occupation Licenses covering 0.5 million acres.[45]

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[43] McLachlan, pp. 10, 13, 14; Department of Lands and Survey, Annual Report, 1968 (Wellington: Government Printer, 1968), p. 5.

[44] McLachlan, p. 13; 1968 Committee, p. 23.

[45] New Zealand Department of Statistics, pp. 98, 300; Pierson, "Public Land Grazing Down Under," pp. 4-5, 12-14.

IV. LAND DISPOSAL POLICIES IN THE NETHERLANDS

The only government studied which stresses leasing rather than selling public lands for intensive agriculture is the Netherlands. Virtually all of its public lands consists of "polders" that have been reclaimed from the North Sea at great cost. Because of this cost the government seeks to realize the greatest possible return on its investment. Apparently it believes this can be more readily achieved by leasing than by selling the land outright.[46]

When completed in the 1970s the polders will yield 500,000 acres of additional farm land to a nation which now possesses only five million acres. Because Netherlanders farm very intensely, the individual plots on the polders are limited to between 30 and 120 acres, with 70 percent consisting of 60 acres or less. As in the other States studied, the Netherlands has attempted to define an adequate farm size for leasing the redistributing land. Presently, there are two schools of thought on the subject. One advocates a size of 15 to 25 acres which will allow an individual farmer "to utilize his entire capacity for work in a rational way." The other faction favors about 35-38 acres to provide sufficient work for two men. It assumes that the farmer will be aided by his sons. Both methods have been applied by local boards under the Land Consolidation Act of 1954. In general, the smaller farms are for market gardening while the larger farms are livestock or dairy farms.[47]

Since the Netherlands has no crop share leases, even under private leasing, all rents are payable in cash; however, the rents are low. Because of the tremendous demand for land since World War II, the government has felt it necessary to hold down all land rents by rent controls. The rents charged are based on soil productivity and also on the value of Crown improvements, which are quite extensive.

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[46] Public Relations and Information Department of the Netherlands Ministry of Transportation and Waterstaat, From Fisherman's Paradise to Farmer's Pride (The Hague: Netherlands Information Service, 1959), p. 52.

[47] Franklin J. Reiss, "New Lands" unpublished and undated paper, Agricultural Economics Department, University of Illinois, (written since 1958); Ministry of Transportation and Waterstaat, From Fisherman's Paradise to Farmer's Pride, p. 48; S. Herweyer, "The Reclamation of, Distribution of, and Settlement in New Cultivatable Land," Netherlands Journal of Agricultural Science 5 (August 1957), p. 170.

The government not only reclaimed the land but also constructed the farm houses. Rents range from £80 an acre-year for sandy and peat soil to £165 an acre-year in the heavy loam soil zone. Rents may be reviewed every three years, but there is no adjustment for changes in commodity prices. The tenant may appeal the lessor's decision to the local Land Chamber whose rulings may in turn be appealed to the Central Land Chamber.[48]

A lack of capital, which handicaps lessees in the other countries included in this study, is not a severe problem in the Netherlands. Since there is a tremendous demand for polder land, the government sets up rigid requirements for tenants, including capital resources. It demands that the applicant have available £640/acre or £38,400 for a 60-acre plot; 25 percent of the total must be the applicant's own money, but up to 50 percent may be borrowed from relatives or others, and up to 25 percent may be in the form of loans from the local Farmers Credit Bank with repayment guaranteed by the Central Farmers Credit Bank.

The government employs additional criteria in selecting tenants; since it is really establishing whole new communities on the reclaimed land, it seeks a population balanced by age, religion, and provincial origin. It also gives preference to applicants who are abandoning uneconomic farm units or who have lost farms in the public interest, for road construction, etc.[49]

The land is leased for 12 years, the minimum period for land with buildings under the Land Rent Act of 1958 that regulates public and private leasing arrangements. The lease is automatically extended for six-year periods unless either party gives notice. Netherlands law allows the government to evict the tenant only for poor husbandry or if land is to be used for a public purpose. The tenant's heir succeeds him, but he must meet certain requirements. Although the State is considering leasing the land for longer terms, the present system seems to guarantee the tenant reasonable security of tenure.

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[48] Reiss, "New Lands," p. 4; Cornelius D. Scheer, "The Place of Tenancy in the Agriculture of the Netherlands," Land Tenure, eds. Kenneth Parsons, Raymond J. Penn, and Philip M. Raup (Madison: University of Wisconsin Press, 1956), pp. 520-1; Foreign Information Service, Ministry of Agriculture and Fisheries, Agriculture in the Netherlands (The Hague: Government Publishing and Printing Office, 1962), p. 52; Ministry of Transportation and Waterstaat, p. 48.

[49] Ministry of Transportation and Waterstaat, p. 54.

The government owns the major improvements such as the farm house, and is responsible for their basic maintenance. Under Netherlands law the tenant is responsible for minor repairs and provides his own machinery and livestock. All improvements are insured by their respective owners. Under the Land Act of 1958, the tenant receives reimbursement for his improvements. Compensation may not exceed the appreciated or increased value of the farm. The amount of use the tenant obtained from his improvements is deducted from his reimbursement. Because the government owns the major improvements on the polders, no great problem of compensation exists.

The State apparently does not impose any more rigid conditions on farming practices than do most nations. It should be remembered that the initial selection process almost always sifts reliable tenants from a host of applicants.[50] In general, the government's leasing policies are well received.

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[50] Ministry of Transportation and Waterstaat, p. 52; Scheer, The Place of Tenancy, pp. 520 ff.

V. SUMMARY AND CONCLUSIONS

Leaseholds and freeholds are widely used methods of disposing of public lands in Alberta and Saskatchewan, Canada, and in Australia, New Zealand, and the Netherlands. The granting of freehold estates is the trend for cropland (except in the Netherlands where almost all public land is leased) while leaseholds remain common for grazing lands. When leaseholds are available for cropland, they are generally for long terms or are perpetual leases. Since more status is attached to land ownership than to leasing, the freehold is the overwhelming choice of farmers, and in many of the Provinces and States the leasehold can be converted into a freehold. The provision for converting is a response to the fact that farmers feel the need of security or fixity of tenure if they are to be free to improve and to operate in a manner that benefits both private and public interests.

The question of fair rents is a constant one, and there appears to be no entirely satisfactory answer. Sale of the land to the farmer is the most popular disposition method, but it too presents problems of land valuation. Various methods of determining value are in use. The sale by sealed bids or open auction is perhaps the least burdensome from an administrative standpoint. Its dangers are that through ignorance of land values, over optimism, or desperation, the farmer may bid more than can be paid for with the income of the farm.

Credit for improvements on both freeholds and leaseholds is also a problem. The down payment on the freehold frequently absorbs capital needed for improvements. The leasehold also has the disadvantage of not being as good security as a freehold for improvement loans.

Farm size has been a major concern of settlers, and they have agitated for increases in the acreage of public land grants. In recent years most of the governments have raised the acreage limits to allow units to become more economically adequate. In Alberta the maximum land grant was increased from 320 to 800 acres, and a similar revision has been made in Saskatchewan.

Whether to dispose of land by leasehold or freehold also involves the basic question: can farmers be trusted, or induced, to handle the land under a freehold so that both private and public interests are better served than under a leasehold? Under the leasehold the State can reserve control over land use by provisions in the lease; however, whether this right to control can be effectively exercised is another matter. The evidence that the State can prevent abuse of land by lease provisions is not impressive.

APPENDIX

OTHER PUBLIC LAND LAW REVIEW COMMISSION STUDY REPORTS AVAILABLE

From the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402

Digest of Public Land Laws. Prepared by Shepard's Citations, Inc., of Colorado Springs, Colorado. 1968. $6.50

History of Public Land Law Development. Written by Professors Paul Wallace Gates of Cornell University and Robert W. Swenson of the University of Utah. 1968. $8.25

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From the Clearinghouse for Federal Scientific and Technical Information, United States Department of Commerce, Springfield, Virginia 22151

Clearinghouse prices for these reports are based upon the number of volumes into which each report is divided, indicated for each report in the following listing. Price: $3.00 per volume for paper printouts; $0.65 per volume for microfiche.

Federal Legislative Jurisdiction. Prepared by the Land and Natural Resources Division, United States Department of Justice. Revised September 1969. One volume. Order number P B 185 920.

Study of Withdrawals and Reservations of Public Domain Lands. Prepared by Charles F. Wheatley, Jr. Revised September, 1969. Order numbers: P B 187-002, P B 187 003, P B 187 004.

Administrative Procedures and the Public Lands. Prepared by The University of Virginia, School of Law. Revised September, 1969. One volume. Order number: P B 187 205.

Fish and Wildlife Resources on the Public Lands. Prepared by the Department of Fishery and Wildlife Biology, Colorado State University. Revised September, 1969. Two volumes. Order number: P B 187 246, P B 187 247.

Public Land Timber Policy. Prepared by George Banzhaf & Company. Revised October, 1969. Four volumes. Order numbers: P B 187-728, P B 187-729, P B 187-730, P B 187-731.

Other study reports available through Clearinghouse
Continued

Study of the Development, Management, and Use of Water Resources on the Public Lands. Prepared by Charles F. Wheatley, Jr., Charles E. Corker, Daniel J. Reed and Thomas M. Stetson. Revised October 1969. Two volumes. Order numbers: PB 188 065, PB 188 066.

CHAPTER 8

LAND POLICY

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Land policy loomed very large in public thinking and action in Australia in its early days. The colony of South Australia was in fact founded in 1836 as a practical test of Edward Gibbon Wakefield's particular theory of land settlement.[1] In the nineteenth century, revenue from land sales was for a long time a major source of public revenue. Parliamentary elections were won or lost on land policy issues.

Today, the administration of land is essentially concerned with carrying out settled policy. It is true that in some Australian States the platforms of the political parties still reflect the beliefs of 50 years ago that subdivision of pre-existing holdings (closer settlement) is the major means of promoting rural development. But as the public becomes more fully aware of the potentialities for agricultural expansion inherent in recent advances in agricultural technology, it is likely that this older emphasis on land redistribution as a means to development will be superseded.

The Australian Federal government as such has no land policy, except in so far as it is directly involved in the administration of the Northern Territory and the overseas territories of Papua and New Guinea. Upon the federation of the Australian States in 1901, the administration of land was one area of public responsibility which was left in the hands of the State governments. All of these States at that time had lands departments as constituent parts of their administrative machinery and this situation still prevails today.

Despite its lack of constitutional authority, the Commonwealth government can nevertheless exercise some indirect influence upon the direction of land policy. This arises mainly from the limited financial autonomy of the States in recent decades. The mark of the Commonwealth government upon land policy was most clearly seen with respect to the scheme for the settlement of ex-servicemen after World War II, which is discussed later. But the Federal government exercises a more continuous influence in a financial con-

1. Edward Gibbon Wakefield, *A Letter from Sydney*, London 1829, republished by J. M. Dent and Sons, London 1929. For an evaluation of the Wakefield doctrine see R. C. Mills, *The Colonisation of Australia, 1829-1842*, Sidgwick and Jackson, London 1915; and S. H. Roberts, *History of Australian Land Settlement*, Macmillan, Melbourne 1924.

From Agriculture in the Australian Economy, ed. D. B. Williams (Sidney, Australia, 1967), by permission of Sidney University Press (price, $8.50).

text. Loan funds used by the States to finance closer settlement activities and for other purposes are reviewed annually on a federal basis at the meeting of the Loan Council, comprised of federal and State finance ministers. Major schemes for land development are also subject to federal review, if federal finance is required, as it usually is. Apart from its participation in land settlement activities, the Federal government levies land taxes and estate duties. These were originally conceived as a means of discouraging the aggregation of land into large holdings.[2]

LAND OWNERSHIP

Australia is probably unique among the western countries in that a high proportion of its land is still in public ownership. Table 8-1 shows in absolute and relative terms the areas alienated and unalienated in the various States in 1964. These figures now change very little from year to year. The

Table 8-1
Ownership of Land, 1964

State or Territory	*Private lands*		*Public lands*		*Total area*
	Alienated	*In process of alienation*	*Leased or licensed*	*Other*[a]	
	m. acres	*m. acres*	*m. acres*	*m. acres*	*m. acres*
N.S.W.	58·9	7·1	113·3	18·8	198·0
Vic.	31·8	2·4	6·1	16·0	56·2
Qld.	26·4	3·8	369·4	27·3	426·9
S.A.	16·0	0·4	146·4	80·5	243·2
W.A.	29·1	14·5	246·5	334·5	624·6
Tas.	6·6	0·2	1·5	8·6	16·9
N.T.	0·3	—[b]	191·4	141·2	333·0
A.C.T.	0·1	—[b]	0·3	0·2	0·6
Australia	169·1	28·5	1,074·8	627·0	1,899·5
	%	%	%	%	%
N.S.W.	29·7	3·6	57·2	9·5	100·0
Vic.	56·5	4·2	10·9	28·4	100·0
Qld.	6·2	0·9	86·5	6·4	100·0
S.A.	6·5	0·2	60·2	33·1	100·0
W.A.	4·7	2·3	39·5	53·5	100·0
Tas.	39·1	1·3	8·6	51·0	100·0
N.T.	0·1	—	57 5	42·4	100·0
A.C.T.	10·6	6·9	47·5	35·0	100·0
Australia	8·9	1·5	56·6	33·0	100·0

a. Land occupied by government agencies, reserved lands, and unoccupied lands.
b. Not significant.

SOURCE: *Year Book*, No 52, 1966, Bureau of Census and Statistics.

2. J. M. Garland, *Economic Aspects of Australian Land Taxation*, Melbourne University Press, Melbourne 1931.

interesting point is that 175 years after the first settlement only 10·4 per cent of the total area of the country had been alienated or was in process of alienation.

The alienated lands, for the most part, are located in the older settled areas, Victoria being the only State with more than half of its lands in private ownership. The large acreages of land held under lease from the government are located predominantly in the more sparsely settled, more arid pastoral areas of Queensland, Western Australia, the Northern Territory, New South Wales and South Australia.

The various forms of land tenure in the various States are broadly similar, the similarity being strongest among the eastern States which originally formed part of New South Wales. Even so, the large number of types of tenure and variety of terms and conditions applying to particular tenures make it impossible to provide a succinct outline of the country's land legislation.[3]

FREEHOLD TENURES

There are two types of freehold tenure. The first, which applies to the greater part of the alienated lands, allows a high degree of freedom to the individual owner to use or to transfer the land as he wishes. The government does retain some control by virtue of the right of eminent domain, the right to tax, and the right to institute land-use regulations in the name of resource conservation.

However, in the case of some of the freehold land acquired in the past 50 years or so, governments have attached a caveat preventing their transfer to persons who already hold more than a specified area of land. This is true, for instance, of lands acquired under conditional purchase tenures and certain other tenures in New South Wales after 1909. In other words, some of the restrictions which apply to lands in process of alienation, described in the next section, apply equally to some freehold land.

THE TENURE OF LANDS IN PROCESS OF ALIENATION

The State governments typically place many conditions upon landholders who are in the process of purchasing their land. Usually there is a limit set on the area which can be acquired, the concept of 'the home maintenance area' or 'living area' being frequently employed as an administrative device in this connection. Sometimes, as with some tenures in New South Wales, there are, in addition, certain acreage maxima applicable to particular regions. In most cases also, it is incumbent on the owner to live on the

3. The most systematic attempt to provide an outline of Australian land legislation was made by the Surveyor-General of Western Australia, Mr W. V. Fyfe, in 1944. This report formed Annexure A of the *Ninth Report* of the Rural Reconstruction Commission, Government Printer, Canberra 1946, but the annexures were not published. A supplementary mimeographed report entitled 'Land Laws and Tenures' covering amendments up to 1948 was issued in 1949.

property for at least five years and to carry out within a prescribed time certain improvements such as clearing and fencing. These latter restraints sometimes impose substantial opportunity costs on the settler.[4]

The principle of the home maintenance area is a pivotal feature of much Australian thinking about land tenure. Various expressions of the concept are to be found in different Acts. A typical definition would be that used in the New South Wales Western Lands Act of 1949, viz. 'an area which when used for the purpose for which it is reasonably fitted would be sufficient for the maintenance in average seasons and circumstances of the average family'. This concept has been used as a criterion in a number of administrative decisions affecting land.[5] First, it has been used to set the maximum area which may be alienated to any one settler whether by allocation or as a result of transfers from others. By the same token, it serves to guide decisions on applications to transfer titles. In more recent times, the concept has been used in determining the area which may be retained by the original holder when land is resumed or surrendered for closer settlement. Third, it has been used in closer settlement programmes, particularly since World War II, to set the minimum areas to be allotted to settlers. As such it became a means of preventing excessive subdivision by over-enthusiastic State officials.

The language of the definition is extremely vague and its interpretation must necessarily be highly subjective. In practice, the ultimate interpretation has to be made by the local administrative units. Commonwealth government oversight of land settlement programmes after World War II did encourage greater objectivity by forcing State lands departments to resort to more precise budgets than they had been wont to use previously. However, whatever the degree of objectivity introduced, the criterion clearly sets a welfare objective in terms of a reasonable level of living and involves no consideration of efficiency. The 'home maintenance area' concept has also been criticized for its scant regard for questions of production variability.[6] The problem of the survival of pastoral businesses in areas of low and irregular rainfall is not amenable to solution in terms of average incomes and average seasons.

In addition to the various forms of freehold tenure, there are in most States several classes of leasehold where the tenant has some right of conversion to freehold tenures. This right is hedged about with a whole host of conditions not the least of which, usually, is the provision relating to home maintenance areas.

4. e.g. I. J. Moncrieff and R. G. Mauldon, 'The Effect of Land Clearing Regulations on the Rate of Farm Development, A Case Study', *Australian Journal of Agricultural Economics*, Vol 7, No 2, December 1963.

5. J. N. Lewis, 'Is the Concept of the Home Maintenance Area Outmoded?', *Australian Journal of Agricultural Economics*, Vol 7, No 2, December 1963, p 97.

6. K. O. Campbell, 'The Challenge of Production Instability in Australian Agriculture', *Australian Journal of Agricultural Economics*, Vol 2, No 1, July 1958, p 9.

LEASES FROM THE GOVERNMENT

There is a wide variety of government leases in operation in the various States. They range from annual leases to perpetual leases, the majority of them being for long periods. For most practical purposes, properties which are held under perpetual leases are virtually indistinguishable from alienated land. Usually the consent of the responsible minister is required before sales or transfers can be effected, but sales (and professional valuations) are made as if the properties in question were freehold. It should be emphasized that these leases relate solely to the land and not to the improvements upon it.

In some of the long-term leases, the rentals set are fixed over time. In other cases the rentals are re-appraised from time to time, e.g. at 10-year intervals. Except where land has been made available for closer settlement after resumption, the rentals charged are usually much lower than the rentals which would prevail on a free market. They can be as low as 1·25 per cent of the notified capital value, which may itself be fixed at a very conservative level. In some cases, as in the Western Division of New South Wales, rentals are fixed at so much per sheep carried, the actual amount payable being based on the assessed carrying capacity of the land.

As might be expected where the prevailing rentals are well below the economic level, the difference tends to be capitalized into the market value of the lease in question. Under certain circumstances, governments take steps to prevent existing tenants from benefiting, at the expense of their successors, from what are, in essence, concessional rentals.

Some of the leaseholds, particularly in Queensland and the Northern Territory, are for fixed periods, and have been criticized for their consequent failure to encourage the maintenance and improvement of the properties in question. The Queensland pastoral leases do however give the outgoing lessee the right to retain a portion of his lease equivalent to a living area. Some of the disabilities of the fixed lease may be offset by the incorporation of specific provisions in the lease. These may require the lessee to carry out, within a defined period, a specific programme of improvements such as construction of fences, or sinking artesian bores; or they may require him not to overstock the land, and to withhold stock from specific sections of the property. Until recently, Northern Territory leases have even specified a minimum rate of stocking. Most leases make provision for compensating the lessee for any improvements on the surrender or expiry of the lease, but others such as annual and forest leases do not.

PRIVATE LEASING

Though leasing of rural lands from the government is widespread in Australia, leasing from private individuals is rather rare, at least by overseas standards. In fact it is so inconsequential that agricultural statisticians do

not bother to collect information on this point. A figure of 2 per cent of rural lands has for many years been quoted as the extent of private leasing in New South Wales.

Share farming is practised to some extent, but is, by and large, confined to wheat and dairy industries. It is also found to a more limited extent in the potato and tobacco industries. In wheat areas, the landlord typically supplies the land and portion of the seed and fertilizer, the share farmer providing the remaining inputs. Half of the product usually goes to each, though in some cases the landlord reserves in addition some grazing rights. There is, however, great variation in the proportions of produce retained by the owner and also in the inputs he supplies. This applies particularly to share farming arrangements in the dairy industry. In some cases the share farmer merely provides his labour and his situation is hardly distinguishable from that of a paid employee.

Most of the States have attempted to afford some measure of legislative protection to agricultural tenants. By far the most ambitious of such legislation is the New South Wales Agricultural Holdings Act of 1911.[7] Originally modelled on the comparable United Kingdom legislation, the Act contains provisions covering (i) security of tenure (ii) payment of compensation for disturbance (iii) payment of compensation for unexhausted improvements (iv) measures for securing agreement between landlord and tenant on certain classes of improvements (v) payment of compensation to the landlord for deterioration in the value of his holding resulting from the failure of the tenant to follow the precepts of good husbandry and (vi) arbitration on the question of fair rents. For arbitration, the Act provides for the constitution of *ad hoc* committees to which both the landlord and the tenant nominate a representative and over which an officer of the Department of Agriculture presides. The committees may at any stage secure an opinion on any question of law from a judge of the district court.

Despite its wide-ranging provisions, the Act has fallen somewhat short of expectations and it is generally acknowledged to be in need of amendment. The chief defect of the legislation from a legal point of view is that both the provisions covering payment of compensation to tenants and those requiring adequate notice to quit have generally proved ineffective in the case of verbal agreements. This is because the Act conflicts with the seventeenth-century English Statute of Frauds which applies equally in Australian law and which provides that any agreement not performed within one year must be in writing if it is to be enforceable. Unfortunately verbal agreements are rather prevalent and landlords themselves are disposed to avoid written contracts in the present circumstances. There is also mounting agitation by land-

7. For details see A. W. S. Moodie and J. R. Butler, *Farm Tenancy in New South Wales*, New South Wales Department of Agriculture, Sydney 1952.

lords for amendment of the Act on the ground that the legislation as it now stands makes it excessively difficult to dismiss inefficient and incompetent tenants and share farmers.

CLOSER SETTLEMENT

Perhaps the most important feature of Australian land policy in the present century has been the policy of closer settlement pursued by the various State governments. The emergence of this pressure for the subdivision of large holdings cannot be fully appreciated except against the background of earlier Australian land policies.[8]

Historically the development of Australian land policy falls into several distinct periods. Initially in the years following on the establishment of the first settlement in New South Wales in 1788, free grants of land were made to induce settlers to come to and stay in the new country. Land was also granted to emancipated convicts on condition that a quit rent was paid after a specified period of occupation. By the 1830s, systems of land grants by purchase (or auction) had been introduced. With their introduction it proved impossible to confine the so-called squatters' to the official limits of settlement and occupation of the hinterland proceeded apace.

A rapid influx of population followed the discovery of gold in 1851. When many erstwhile miners began to look to farming as an alternative occupation after goldmining had lost its attractiveness for them, they found the best land already occupied by the squatters. Considerable agitation for land reform followed and this coincided with the establishment of self-government. In the early 1860s the new Victorian and New South Wales State parliaments passed legislation making land more accessible to would-be settlers and encouraging agricultural activities side by side with large pastoral leases. The New South Wales Acts of 1861 introduced the new principle of free selection before survey. This legislation led to various abuses such as dummying and within a quarter of a century further legislative enactments were necessary to remedy the situation. From that time forward the whole emphasis shifted to closer settlement.

By a series of legislative enactments all the States developed machinery for resuming large pastoral holdings, subdividing them, and making the smaller blocks available to other settlers usually by a system of simple balloting. Not all the closer settlement was promoted by compulsory acquisition. Provision was made for owners voluntarily to enter into agreements for the subdivision of their holdings. Pastoral companies having large holdings in favoured districts, particularly those companies with their headquarters overseas, have been particularly prone to resumption.

8. The classic work in this field is S. H. Roberts, *op. cit.* For New South Wales developments see C. J. Ving, 'An Outline of Closer Settlement in New South Wales', *Review of Marketing and Agricultural Economics*, Vol 25, Nos 3-4, September-December 1957.

The actual procedure of resumption has on occasions left much to be desired. The chief restraint, apart from the administrative one of limited staff, has been the availability of money to finance the purchase of the resumed estates and to finance the new settlers. (Traditionally credit for such settlers has been provided by the governments themselves, at concessional rates of interest.) This means that the pace of closer settlement has varied substantially over time, depending *inter alia* on the state of the economy, the rate at which capital has become available, the market prospects for rural products, the degree of success attending earlier settlements, and the rival claims of other public works programmes. To safeguard the government against paying higher values for estates resumed, the practice has grown up of 'proclaiming' estates destined for subdivision long before resumption was effected. This kept costs of resumption down, but it also discouraged further private investment on the properties concerned. The inequities of this system are apparently now being realized. In 1966, the New South Wales government announced the lifting of proclamations from a long list of estates the acquisition of which it could not finance for a considerable time to come.

Lands administrators have in recent decades been loath to subdivide properties where sheep studs are maintained. It is argued that these studs require large flocks (and consequently large areas) to work effectively and that the perpetuation of the studs is in the national interest.

Several attitudes and indeed myths have developed about closer settlement. It was long regarded as one of the chief means of developing the rural industries, and the beneficial effects of subdivision on the adjoining country towns were applauded. It was said to be a way of stemming the 'drift to the cities' and of providing opportunities for farmers' sons to remain on the land. It has also become identified in the public mind as a fitting method of rehabilitating ex-servicemen. After both world wars, emphasis has been put on the settlement of ex-servicemen to the exclusion of civilian settlers. In fact, in such periods, the activity becomes known as 'soldier settlement' rather than closer settlement.

Large numbers of ex-servicemen were in fact assisted to acquire properties after World War I. Even before the onset of the Great Depression many of these men were in severe economic difficulties. In some cases, they were inadequately trained in farming. In other cases the holdings on which they were placed were too small. In still other cases, soil and agronomic investigations before settlement had been inadequate. Several committees of enquiry were conducted, and a large amount of public funds was spent in reconstructing holdings and rehabilitating the settlers.[9]

9. See Commonwealth of Australia, *Report by Mr. Justice Pike on Losses due to Soldier Settlement*, Government Printer, Canberra 1929; and Rural Reconstruction Commission, *Settlement and Employment of Returned Men on the Land, Land Utilization and Farm Settlement, Financial and Economic Reconstruction of Farms* (*Second, Third* and *Fourth Reports*), Government Printer, Canberra 1944.

THE WAR SERVICE LAND SETTLEMENT SCHEME

The prospect of further pressure for the settlement of ex-servicemen on the land after World War II led the Commonwealth government to prepare in advance for such an eventuality as part of its postwar reconstruction plans. In 1945 a series of agreements was drawn up between the Commonwealth government and the States covering their respective financial obligations for the acquisition of holdings, the development of these holdings and advances to settlers. In general, the States of Queensland, New South Wales and Victoria (the principal States) bore half the cost of most items, the remaining States (the agent States) bearing a smaller proportion.[10]

The most important feature of the so-called War Service Land Settlement Scheme was the set of principles enunciated in the course of concluding the agreements. It is fair to say that these set the stage for the closer settlement activities of the past 20 years. The principles were as follows:

(i) Settlement is to be undertaken only where economic prospects are reasonably sound; and the number of eligible persons to be settled is to be determined by the opportunities for settlement and not by the number of applicants;

(ii) Applicants are not to be selected as settlers unless satisfying a competent authority as to their eligibility, suitability and qualifications for settlement under the scheme and their experience of farm work;

(iii) Holdings are to be of a size sufficient to enable settlers to operate efficiently and to earn a reasonable labour income;

(iv) A suitable eligible person is not to be precluded by reason only of lack of capital, but a settler is expected to invest in the holding a reasonable proportion of his own financial and other resources; and

(v) Adequate guidance and technical advice is to be made available to settlers through agricultural extension services.[11]

Under this scheme, all subdivisions were examined by the Commonwealth government, before any Federal finance was authorized. Special training schemes for intending settlers were provided. In some States in accordance with custom, the blocks available were allocated by ballot among the persons who had applied and were approved for inclusion in the ballot. Though the Act authorizing it was declared constitutionally invalid in 1949, the scheme was continued. Judged on its objectives, the scheme was highly successful in marked contrast to the failures following World War I. Part of the success, no doubt, must be attributed to the improvement of commodity prices which

10. For fuller details of the scheme see 'War Service Land Settlement--Some Agricultural and Financial Aspects of Joint Commonwealth-State Legislation', mimeo., Bureau of Agricultural Economics, 1950; and *Year Book*, No 37, 1946-47, pp 118-119, Bureau of Census and Statistics.

11. Commonwealth of Australia, *War Service Land Settlement Agreement Act*, No 52 of 1945.

occurred in the early years of the scheme, and which resulted in many of the new settlers receiving incomes well in excess of those contemplated. Whether or not the community at large received benefits commensurate with the cost of the scheme is another question.

FARM CONSOLIDATION

Though the predominant theme of its land policy has been closer settlement, Australia has had some experience in the reconstruction of uneconomic holdings. This chiefly occurred as a result of the failure of some of the settlement schemes of the 1920s and was associated with the wheat industry in particular. The Commonwealth government assisted the States in a series of salvage operations, known as marginal wheat area schemes,[12] which were undertaken mainly in the 10 years following the Great Depression. In many cases, a writing-down of debts and restructuring of financial obligations were all that was involved. In other cases, bankrupt settlers were given a lump sum on the condition that they vacated their holdings, their properties were divided and the resultant portions were added to those of adjoining property owners in order to bring the reconstructed farms up to a size which was believed to be economically viable.

A similar system of reconstruction of farms was recommended in 1960 by the Dairy Industry Committee of Enquiry as a means of eliminating low-income farms from that industry, but the recommendations were not accepted by the government of the day.[13]

UNSETTLED ISSUES IN LAND POLICY

In recent years the emphasis in Australian lands administration has shifted primarily to problems associated with fostering the better use of the land already in use. In one sense this was true of the original policy of closer settlement, but even this policy has recently been questioned.

THE PLACE OF CLOSER SETTLEMENT

Several factors have been responsible for this re-examination. First, the development of Australian agriculture in the past 15 years has led to a realization that modern agricultural technology is likely to have a greater impact on the rate of economic growth than any policy of redistribution of rural holdings. It has also become apparent that the market outlook for products of intensive agricultural settlement is less favourable than is the outlook for products produced under more extensive pastoral systems, products in which Australia clearly has a comparative advantage. Third, the rising capital re-

12. See Rural Reconstruction Commission, *Financial and Economic Reconstruction of Farms, Fourth Report*, Government Printer, Canberra 1944, Appendix I.

13. Commonwealth of Australia, *Report of the Dairy Industry Committee of Enquiry*, Government Printer, Canberra 1961.

quirements of modern farming have increased the cost of government-sponsored settlement schemes. Finally, policy makers are coming to realize that in a competitive situation, there is a limit to the priority that can be given to equity objectives over efficiency objectives in any land programme.[14]

Those who favour the abandonment or at least the modification of traditional closer settlement policy point out that the important restraints to rising productivity today are not land and labour, as this policy implies, but capital and management.[15] To continue to attempt to put more people on smaller-sized farms is to fly in the face of historical tendencies for the rural work force to decline and the size of farms to increase.

It is argued that the social reasons advanced in favour of closer settlement frequently do not bear critical examination and that the policy is a very crude and unsatisfactory way of trying to achieve a more equitable distribution of rural income. Such an objective, it is claimed, could be achieved more effectively through such measures as progressive income taxation, land taxes and death duties. The allocation of landholdings by lottery, a procedure by which it is possible for large gains to accrue to a few fortunate people, is also criticized. However, financial pressures are forcing land settlement authorities increasingly to take into account the capital which the intending settler has or to which he can get access privately, in determining the eligibility of applicants for blocks of land. This has been true of the recent Colleambally Settlement Scheme in New South Wales, the Esperance Scheme in Western Australia and the Brigalow Scheme in Queensland.

The main economic arguments centre on the question of economies of scale. A size of farm determined on the criterion of the 'home maintenance area' is not necessarily the most efficient size under current conditions and it is likely to be less so with the passage of time. Unfortunately unequivocal evidence on the scale question is not available.[16] However, it is evident that family farms considered big enough for wheat farming in the days of horse traction are inadequate to achieve realizable economies of scale under mod-

14. Cf. Vernon W. Ruttan, 'Equity and Productivity Issues in Modern Agrarian Reform Legislation', paper presented to the Conference organized by the International Economic Association on Economic Problems of Agriculture in Industrial Societies and Repercussions in Developing Countries, Rome 1965.

15. For a useful summary of the issues involved in the reappraisal of closer settlement policy see D. E. Maccallum *et al.*, 'Closer Settlement in the 1960s', *Journal of the Australian Institute of Agricultural Science*, Vol 28, No 3, September 1962. For an advocacy of the continuation of closer settlement see T. H. Strong, 'Land Tenure in Australia in Relation to Technical Advances and Closer Settlement', *Journal of Farm Economics*, Vol 38, No 2, May 1956.

16. Production function analysis has revealed evidence of increasing returns to scale in the inland pastoral areas and constant returns to scale in the higher rainfall areas. See J. H. Duloy, 'The Allocation of Resources in the Woolgrowing Industry', *Australian Journal of Agricultural Economics*, Vol 5, No 2, December 1961. See also J. N. Lewis, *op. cit.*, pp 100-101; and A. G. Lloyd, 'The Economic Size of Farms', *Journal of the Australian Institute of Agricultural Science*, Vol 27, No 3, September 1961.

ern tractor technology. The pressing need is to find a means of preserving sufficient flexibility in the settlement pattern and the associated land legislation so as not to inhibit the nation from reaping the fruits of continuing technological advance. The establishment of a cotton industry in northern New South Wales a few years ago was originally threatened by anachronistic legislative provisions governing the size of farms.

In recent years closer settlement has gradually assumed less prominence as an instrument of government policy. This trend is likely to continue, if only because of the rising cost of settlement schemes and the realization that they tend to benefit the few rather than the many. It may also become clearer to governments that investment in other directions, whether within agriculture (for example, in education and research) or elsewhere in the economy, would be likely to contribute more to the economic growth of the nation than the investment of an equivalent amount of government funds in closer settlement activities.

LEASEHOLD VERSUS ALIENATION

There has been recurring argument whether additional land should be alienated. Political beliefs obviously colour attitudes to this question. But in an economic context a balance has to be struck between, on the one hand, the savings in private capital investment and the greater public control of land use which leasing arrangements permit and, on the other hand, the disincentive to investment and encouragement of land exploitation which often seems to be associated with such arrangements. The disadvantages of leasehold tenure tend to be more exaggerated the shorter the lease. The situation of landholders operating under perpetual leases, we have seen, differs little from landholders who own their own land.

The Rural Reconstruction Commission was asked by the Commonwealth government in 1943 to recommend the form of tenure which should apply in the settlement of ex-servicemen after World War II. The Commission reported in favour of private ownership,[17] but ultimately the Commonwealth government insisted that land be made available under leasehold tenures in the 'agent' States and subsequently the 'principal' States with the exception of Victoria followed suit.

Today, controversy largely revolves around the leases operating in the pastoral areas of Queensland and the Northern Territory. These leases usually run from 25 to 40 years. They do, it should be noted, give the government the opportunity to reassess property sizes periodically in the light of technological and economic developments. However, as has been pointed out earlier, the lessees claim that the limited term of the leases is not conducive to their developing their properties. There would seem to be substance in the view that the achievement of a satisfactory rate of development

17. See Rural Reconstruction Commission, *Rural Land Tenure and Valuation, Ninth Report*, Government Printer, Canberra 1946.

of the Northern Australian beef industry will be dependent on the institution of a more progressive land tenure policy.[18]

SOIL AND RANGE CONSERVATION

Between 1938 when the New South Wales Soil Conservation Service was established and the end of World War II, most of the Australian States established agencies concerned with the promotion of soil conservation.[19] From the beginning, particular attention was paid to the deterioration of the vegetation in the more arid areas and to soil erosion on the catchments of major dams. Legislation to enable the government to require corrective action on freehold as well as leasehold land in such areas has gradually been introduced, but in few cases have these powers been used. More recently the question of the incorporation of more stringent controls in leases to prevent pasture deterioration has arisen. One case involved the short-term snow leases in the Australian Alps. Another concerned the pastoral leases in Central Australia.[20] In neither case did it appear that the administering authority had sufficient knowledge of the behaviour and management of the native vegetation to be in a position to institute rational controls over grazing.[21]

BALANCING DEVELOPMENT ON NEW AND OLD LANDS

Since the turn of the century, a proportion of public investment in land development has gone into irrigation development. More lately the discovery of minor element deficiencies in some areas and the development of chemical and mechanical methods of land clearing have opened up new opportunities for both corporate and government investment. Perhaps the really burning question in Australian land policy today concerns the relative advantages of public investment in different forms of land development—irrigation versus dry-land development, the opening-up of new lands in Northern Australia versus intensification of development in the already developed areas of the

18. For discussion of some of the issues with respect to the Northern pastoral leases see Commonwealth of Australia, *Report of the Board of Inquiry into the Land and Land Industries of the Northern Territory of Australia*, Government Printer, Canberra 1937; Queensland Government, *Report of the Royal Commission on Pastoral Lands Settlement*, Government Printer, Brisbane 1951; Queensland Government, *Report on Progressive Land Settlement in Queensland by the Land Settlement Advisory Commission*, Government Printer, Brisbane 1959; and H. Barclay, 'Land Tenure in Relation to Agricultural and Pastoral Development', in *Proceedings of the Northern Territory Scientific Liaison Conference*, Darwin 1961.

19. For a review of these developments see K. O. Campbell, 'The Development of Soil Conservation Programmes in Australia', *Land Economics*, Vol 24, No 1, February 1948.

20. See Department of Territories, Northern Territory Land Board, *Report on the Centralian Pastoral Industry under Drought Conditions*, Darwin 1964. It is of interest to note that this committee reported that the minimum size of an economic holding in Central Australia was in excess of 600 square miles.

21. K. O. Campbell, 'Problems of Adaptation of Pastoral Businesses in the Arid Zone', *Australian Journal of Agricultural Economics*, Vol 10, No 1, June 1966, pp 15-16.

south and so on.[22] Details of some of the specific development schemes are outlined elsewhere in this book.

Clearly in a country where the man-land ratio is so low, questions of land policy will continue to exercise the public mind. But unless Australians come to appreciate better than they do now that other resources are to a considerable extent effective substitutes for land and water, they will fail to achieve the full agricultural potentiality of their country.

22. See K. O. Campbell, 'The Rural Development of Northern Australia', *Australian Journal of Agricultural Economics*, Vol 6, No 1, September 1962; B. R. Davidson, *The Northern Myth*, Melbourne University Press, Melbourne 1965; B. R. Davidson and J. S. Nalson, 'Investment Opportunities in Western Australian Agriculture', *Farm Policy*, Vol 3, No 4, March 1964; R. W. Prunster, 'Alternatives in Land Development', *Farm Policy*, Vol 4, No 3, December 1964, and K. O. Campbell, 'An Assessment of the Case for Irrigation Development in Australia', in Australian Academy of Science, *Water Resources, Use and Management*, Melbourne University Press, Melbourne 1964.